

NASA TECHNICAL MEMORANDUM

NASA TM-78203

(NASA-TM-78203) FY 1978 SCIENTIFIC AND
TECHNICAL REPORTS, ARTICLES, PAPERS, AND
PRESENTATIONS (NASA) 79 p HC A05/MF A01

CSCI 05B

N79-13915

Unclas

G3/82 40348

FY 1978 SCIENTIFIC AND TECHNICAL REPORTS,
ARTICLES, PAPERS, AND PRESENTATIONS

Compiled by O. L. White
Management Services Office



October 1978

NASA

*George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama*

1. REPORT NO. NASA TM-78203	2. GOVERNMENT ACCESSION NO.	3. RECIPIENT'S CATALOG NO.
4. TITLE AND SUBTITLE FY 1978 Scientific and Technical Reports, Articles, Papers, and Presentations		5. REPORT DATE October 1978
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Compiled by O. L. White		8. PERFORMING ORGANIZATION REPORT #
9. PERFORMING ORGANIZATION NAME AND ADDRESS George C. Marshall Space Flight Center Marshall Space Flight Center, Alabama 35812		10. WORK UNIT NO.
		11. CONTRACT OR GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS National Aeronautics and Space Administration Washington, D.C. 20546		13. TYPE OF REPORT & PERIOD COVERED Technical Memorandum
		14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

Management Services Office, Administration and Program Support

16. ABSTRACT

This document presents formal NASA technical reports, papers published in technical journals, and presentations by MSFC personnel in FY 78. It also includes papers of MSFC contractors.

After being announced in STAR or L STAR, all of the NASA series reports may be obtained from the Scientific and Technical Information Facility, P.O. Box 8757, Baltimore/Washington International Airport, Baltimore, MD 21240.

The information in this report will be of value to the scientific and engineering community in determining what information has been published and what is available.

17. KEY WORDS		18. DISTRIBUTION STATEMENT Unclassified — Unlimited	
19. SECURITY CLASSIF. (of this report) Unclassified	20. SECURITY CLASSIF. (of this page) Unclassified	21. NO. OF PAGES 79	22. PRICE NTIS

FOREWORD

In accordance with the NASA Space Act of 1958 the MSFC has provided for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof.

Since July 1, 1960, when the George C. Marshall Space Flight Center was organized, the reporting of scientific and engineering information has been considered a prime responsibility of the Center. Our credo has been that "research and development work is valuable, but only if its results can be communicated and made understandable to others."

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GEORGE C. MARSHALL SPACE FLIGHT CENTER
Marshall Space Flight Center, Alabama

FY 1978 SCIENTIFIC AND TECHNICAL REPORTS,
ARTICLES, PAPERS, AND PRESENTATIONS

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TM-78118* November 1977
Terrestrial Environment (Climatic) Criteria Guidelines for Use in Aerospace Vehicle Development, 1977 Revision. John W. Kaufman, Editor. Space Sciences Laboratory. N78-13108

This document provides guidelines on terrestrial environment data specifically applicable for NASA aerospace vehicles and associated equipment development. The primary geographic areas encompassed are the Kennedy Space Center, Florida; Huntsville, Alabama; Vandenberg AFB, California; Edwards AFB, California; Honolulu, Hawaii; Guam; Santa Susana, California; Brigham, Utah; New Orleans, Louisiana; Bay St. Louis, Mississippi; Houston, Texas; Wallops Flight Center, Wallops Island, Virginia; and the White Sands Missile Range, New Mexico. In addition, a section has been included to provide information on the general distribution of natural environmental extremes in the conterminous United States that may be needed to specify design criteria in the transportation of space vehicle subsystems and components. Although not considered as a specific vehicle design criterion, a section on atmospheric attenuation has been added since certain earth orbital experiment missions are influenced by the earth's atmosphere. A summary of climatic extremes for worldwide operational needs is also included. This document presents the latest available information on probable climatic extremes and succeeds information presented in TM X-64589 and TM X-64757. Information is included on atmospheric chemistry, seismic criteria, and on a mathematical model to predict atmospheric dispersion of aerospace engine exhaust cloud rise and growth. There is also a new section on cloud phenomena. The information in this report is recommended for use in the development of aerospace vehicle and associated equipment design and operational criteria, unless otherwise stated in contract work specifications.

The environmental data in this report are primarily limited to information below 90 km. Environmental criteria for 90 km and above are documented in NASA Technical Memorandum TM-78119, Space and Planetary Environment Criteria Guidelines for Use in Space Vehicle Development (1977 Revision).

TM-78119* November 1977
Space and Planetary Environment Criteria Guidelines for Use in Space Vehicle Development, 1977 Revision. G. S. West, Jr., J. J. Wright, and H. C. Euler, Editors. Space Sciences Laboratory. N78-15146

This document provides a consolidated presentation of space and planetary natural environment data for use as design criteria guidelines in space vehicle development programs.

Specifically, information is provided in the disciplinary areas of atmospheric and ionospheric properties, radiation, solar cycle predictions, geomagnetic field, astrodynamics constants, and meteoroids for the earth's atmosphere above 90 km, interplanetary space, and the atmospheres and surfaces (when available) of the moon and the planets (other than earth) of this solar system. The current MSFC upper atmosphere model and solar cycle prediction routines are described in detail.

This document succeeds NASA TM X-64627 entitled "Space and Planetary Environment Criteria Guidelines for Use in Space Vehicle Development, 1971 Revision." The information in this new edition is recommended for use in the development of space vehicle and associated subsystem design and operational criteria unless otherwise stated in a given project's engineering specifications.

For regions of the earth's atmosphere below 90 km, terrestrial environment criteria

* See notation, page 19.

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are documented in NASA Technical Memorandum TM-78118 entitled "Terrestrial Environment (Climatic) Criteria Guidelines for Use in Aerospace Vehicle Development, 1977 Revision."

TM 78125* November 1977
Space Processing Applications Rocket
Project SPAR II Final Report. Space
Processing Applications Rocket Project
Office, Special Projects. N78-15145

This document summarizes the experiment objectives, design/operational concepts, and final results of each of six materials science experiments conducted during the second Space Processing Applications Rocket (SPAR) mission flown by NASA May 17, 1976. The six individual SPAR experiments, covering a wide and varied range of materials processing objectives, were entitled:

1. Solidification of Pb-Sb Eutectic
2. Feasibility of Producing Closed-Cell Metal Foams
3. Direct Observation of Dendrite Remelting and Macrosegregation in Castings
4. Agglomeration in Immiscible Liquids
5. Casting Dispersion — Strengthened Composites at Zero Gravity
6. Solidification Behavior of Al-In Alloys under Zero-Gravity Conditions.

TM-78126 July 1977
C-MOS Bulk Metal Design Handbook.
Teddy M. Edge. Electronics and Control
Laboratory. N77-86193

The LSI standard cell array technique has been used in the fabrication of more than 20 C-MOS custom arrays. This technique consists of a series of computer programs and

design automation techniques implemented at Marshall Space Flight Center and referred to as the Computer Aided Design And Test (CADAT) system that automatically translate a partitioned logic diagram into a set of instructions for driving an automatic plotter which generates precision mask artwork for complex LSI arrays of C-MOS standard cells. The standard cell concept for producing LSI arrays begins with the design, layout, and validation of a group of custom circuits called standard cells. Once validated, these cells are given identification or pattern numbers and are permanently stored. To use one of these cells in a logic design, the user calls for the desired cell by pattern number. The Place, Route in Two Dimension (PR2D) computer program is then used to automatically generate the metalization and/or tunnels to interconnect the standard cells into the required function.

This report contains data sheets that describe the function, artwork, and performance of each of the standard cells, the general procedure for implementation of logic in C-MOS standard cells, and additional detailed design information.

TM-78130 August 1977
Earth Resources — Regional Transfer
Activity Contracts Review and
Summary. J. Bensko, Jr., J. L. Daniels,
S. W. Downs, Jr., N. L. Jones, R. R.
Morton, and C. T. Paludan. Data Sys-
tems Laboratory. N77-33578

The Earth Resources Office, Data Systems Laboratory, Marshall Space Flight Center, hosted a Regional Transfer Activity Contracts Review on February 15-17, 1977. Twenty-one contracts in the Earth resources field primarily directed toward applications of satellite data and technology in solution of state and regional problems were reviewed.

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This report gives a summary of the progress of each contract. The purpose of the review, and of this report, is to encourage the sharing of experiences of the researchers across a seven-state region. The region includes Missouri, Kentucky, Tennessee, Mississippi, Alabama, Georgia, and North Carolina.

In addition to research in several Earth science disciplines, which included forestry, limnology, water resources, land-use, geology, and mathematical modeling, the use of computers for establishment of information retrieval systems in the several states was emphasized.

TM-78131 September 1977
A Prediction Model to Forecast the Cost
Impact from a Break in the Production
Schedule. Dr. Leon M. Delionback.
Systems Analysis and Integration
Laboratory. N77-34044

The losses which are experienced after a break or stoppage in sequence of a production cycle portends an extremely complex situation and involves numerous variables, some of uncertain quantity and quality. There are no discrete formulas to define the losses during a gap in production. The techniques which are employed are therefore related to a prediction or forecast of the losses that take place, based on the conditions which exist in the production environment. Such parameters as learning curve slope, number of predecessor units, and length of time the production sequence is halted are utilized in formulating a prediction model.

The pertinent current publications related to this subject are few in number, but are reviewed to provide an understanding of the problem.

Example problems are illustrated together with appropriate trend curves to show the approach. Solved problems are also given to show the application of the models to actual cases or production breaks in the real world.

TM-78132 August 1977
Large-Size Monodisperse Latexes as a
Commercial Space Product. Dale M.
Kornfeld. Space Sciences Laboratory.
N78-10293

Dr. John W. Vanderhoff of Lehigh University has proposed Orbital Flight Tests and Spacelab experiments leading to the production of large-size (2 to 40 μm diameter) monodisperse latexes in microgravity. Explanations are given as to why monodisperse particles in this size range are not currently available. The four main topics discussed are: (1) the potential uses of these large particle size latexes, (2) why it is necessary for the particles to have a very narrow size distribution, (3) why large amounts of these monodisperse latexes are needed, and (4) why it is necessary to go to microgravity to prepare these latexes.

TM-78133 October 1977
A Fast Routine for Computing
Multidimensional Histograms. Robert R.
Jayroe, Jr. Data Systems Laboratory.
N77-85837

This report describes a routine for calculating multidimensional histograms of multivariate data using a combination table look-up and search procedure. The software was originally developed to compute four-dimensional histograms from Landsat multispectral imagery, but the concept can be used on other types of data and the program can be modified for the desired type of output information.

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TM-78134 September 1977
Advanced Spacecraft Thermal Control
Techniques. Carl H. Fritz. Preliminary
Design Office. N78-10414

The problems of rejecting large amounts of heat have been significantly studied during the past decade. Shuttle Space Laboratory heat rejection uses 1 kW_e for pumps and fans for every 5 kW_t heat rejection. This is rather inefficient, and for future programs more efficient methods must be developed.

This review is based on a 1971 Grumman Aerospace Corporation study with slight changes and improvements. Two advanced systems were studied and compared to the present pumped-loop system. The advanced concepts are the air-cooled semipassive system, which features rejection of large percentage of the load through the outer skin, and the heat pipe system, which incorporates heat pipes for every thermal control function.

Other systems should be reviewed to find the most efficient heat rejection system for payloads in the 1990's. The system selected must use standardized components to reduce test requirements. Paints and other materials used for long-life duration must also be found.

TM-78135 September 1977
Spacelab Baseline ECS Trace Contaminant Removal Test Program. C. D. Ray and J. B. Stanely. Structures and Propulsion Laboratory and Test Laboratory. N78-10197

"Off-the-shelf" components which have been demonstrated to offgas considerable quantities of trace contaminant gases will be flown as a part of Spacelab payload equipment. An estimate of the Spacelab Baseline Environmental Control System's

contaminant removal capability was required to allow determination of the need for a supplemental trace contaminant removal system. Results from a test program to determine this removal capability are presented.

TM-78136 September 1977
Ground Winds and Winds Aloft for Edwards, AFB, California. D. L. Johnson and S. C. Brown. Space Sciences Laboratory. N78-11637

This report presents ground-level runway wind statistics for the Edwards AFB, California area. Crosswind, tailwind, and headwind reversal percentage frequencies are given with respect to month and hour for the two major Edwards AFB runways. Also presented are Edwards AFB bivariate normal wind statistics for a 90 degree flight azimuth for altitudes 0 through 27 km. Wind probability distributions, synthetic vector wind profiles, and statistics for any rotation of axes can be computed from the five given parameters: \bar{u} , \bar{v} , $S(u)$, $S(v)$, and $R(uv)$.

TM-78137* January 1978
Space Processing Applications Rocket Project SPAR III Final Report. Space Processing Applications Task Team. N78-21189

This document presents the engineering report and science payload III test report and summarizes the experiment objectives, design/operational concepts, and final results of each of five scientific experiments conducted during the third Space Processing Applications Rocket (SPAR) flight flown by NASA in December 1976. The five individual SPAR experiments, covering a wide and varied range of scientific materials processing objectives, were entitled: Liquid Mixing, Interaction of Bubbles with Solidification Interfaces, Epitaxial Growth of Single Crystal

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Film, Containerless Processing of Beryllium, and Contact and Coalescence of Viscous Bodies.

TM-78138 October 1977
FY 1977 Scientific and Technical
Reports, Articles, Papers, and Presentations.
Compiled by O. L. White.
Management Services Office.

This document presents formal NASA technical reports, papers published in technical journals, and presentations by MSFC personnel in FY 77. It also includes papers of MSFC contractors.

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TM-78139 September 1977
An Analysis of Maximum Vertical Gusts
Recorded at NASA's 150-Meter Ground
Winds Tower Facility at Kennedy Space
Center, Florida. Margaret B. Alexander.
Space Sciences Laboratory. N78-13700

A statistical summary is presented of vertical wind speed data recorded at NASA's 150-Meter Ground Winds Tower Facility on Merritt Island, Kennedy Space Center, Florida. One year of continuous around-the-clock vertical wind speed measurements processed by the Automatic Data Acquisition System (ADAS) is classified as a function of tower level (10, 18, 60, and 150 meters) and period of reference [day, month, season: winter (October through March) and summer (April through September), and annual].

Intensity, frequency, time of occurrence, prevailing conditions, etc., of the daily maximum vertical gusts (i.e., updraft and downdraft) are determined. The results are compared with the vertical gusts associated with the daily maximum horizontal gust. The intent of this summarization of vertical wind speed data is to provide a general description of wind flow in the lower 150 meters of the atmosphere for the identification of hazards involved in wind shear encounters relative to ascent and descent of the Space Shuttle and conventional aircraft.

TM-78140 September 1977
A Technique to Correct for Sample
Thickness Variations for Use with
IDAPS X-Ray Radiograph Analysis.
Charles F. Schafer and Mark Paulk.
Space Sciences Laboratory. N78-12197

The Image Data Processing System (IDAPS) at the Marshall Space Flight Center has been used to analyze radiographs of metal samples to qualitatively and quantitatively map compositional variations across the samples. When the X-ray radiographs are of samples having thickness variations, corrections must be made to accomplish compositional analysis. A correction technique is described for cylindrical samples and is applied to radiographs of SPAR Experiment 74-18. Uncorrected and corrected images are shown.

TM-78141 November 1977
A Technique for Simulating Turbulence
for Aerospace Vehicle Flight Simulation
Studies. George H. Fichtl. Space
Sciences Laboratory. N78-12014

A technique for simulating atmospheric turbulence that accommodates variability of turbulence properties along an aerospace vehicle trajectory is developed. The technique involves the use of Dryden spectral forms in

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which the defining parameters are the standard deviations (σ) and integral scales (L) of turbulence. These spectra are expressed as nondimensional functions of the nondimensional frequency $\Omega = \omega L/V$ where ω is dimensional radian frequency and V is the true air speed of the aerospace vehicle. The nondimensional spectra are "factored" by standard techniques to obtain nondimensional linear recursive filters in the time domain whereby band-limited white-like noise can be operated upon to obtain nondimensional longitudinal, lateral, and vertical turbulence velocities, u/σ_u , v/σ_v , and w/σ_w , respectively, as functions of nondimensional time, tV/L , where t is time. Application of the technique to the simulation of the Space Shuttle Orbiter entry flight phase is discussed.

TM-78142 September 1977
Single Node Orbit Analysis with Radiation Heat Transfer Only. Jerry A. Peoples. Preliminary Design Office.
N78-14314

The steady-state temperature of a single node which dissipates energy by radiation only is discussed for a non-time-varying thermal environment. Relationships are developed to illustrate how shields can be utilized to represent a louver system. A computer program is presented which can assess periodic temperature characteristics of a single node in a time-varying thermal environment having energy dissipation by radiation only. The computer program performs thermal orbital analysis for five combinations of plate, shields, and louvers.

TM-78143 October 1977
In-Space Production of Large Space Systems from Extraterrestrial Materials - A Program Implementation Model.
Georg F. von Tiesenhausen. Program Development.

N78-12112

A program implementation model is presented which covers the in-space construction of certain large space systems from extraterrestrial materials. The model includes description of major program elements and subelements and their operational requirements and technology readiness requirements. It provides a structure for future analysis and development.

TM-78144 **October 1977**
Mixing of Two Liquid Metals on SPAR
Payload Due to Spin-Up and Spin-Down.
Charles F. Schafer. Space Sciences
Laboratory. N78-13090

The work described was motivated by unexpected results from SPAR experiments directed at obtaining fine dispersions of metal systems that in a 1-g environment tend to segregate very rapidly. The SPAR samples exhibited segregation also. The physical processes occurring in fluid samples, such as the SPAR samples before solidification, are shown to be insufficient to produce a well-mixed liquid by the time solidification was initiated. This would result in solidified samples with the type of segregation noted in the SPAR samples. Experimental evidence and analytical arguments are presented.

TM-78146 November 1977
Candidate Locations for SPS Rectifying
Antennas. Anne W. Eberhardt. Pre-
liminary Design Office. N78-13553

An investigation is made into the feasibility of placing 120 Satellite Power System (SPS) rectifying antenna (rectenna) sites across the U.S. In the investigation, an initial attempt is made to put two land sites in each state using several land site selection criteria. When only 69 land sites are located, it is decided to put the remaining sites in the sea and sea site selection criteria are identified. An estimated projection of

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electrical demand distribution for the year 2000 is then used to determine the distribution of these sites along the Pacific, Atlantic, and Gulf Coasts. A future study will also attempt to include the Great Lakes in this distribution.

As a result of this study, a methodology for distributing rectenna sites across the country and for fine-tuning exact locations is developed, and recommendations on rectenna design and operations are made. This developed methodology will be used in the reevaluation of the rectenna sites identified in this preliminary study. It is suggested that the design recommendations be considered in future rectenna design studies.

TM-78147 December 1977
Data for NASA's AVE VI Experiment:
25-mb Sounding Data and Synoptic
Charts. Leonard R. Dupuis and Kelly
Hill. Space Sciences Laboratory.
N78-15628

This report describes the AVE VI Experiment and presents tabulated rawinsonde data at 25-mb intervals from the surface to 25 mb for the 22 stations participating in the experiment. Soundings were taken between 0000 GMT May 27 and 1200 GMT May 28, 1977. The methods of data processing and the accuracy are briefly discussed. Synoptic charts prepared from the data are presented together with an example of contact data.

TM-78148 November 1977
Status Report: Data Management Program Algorithm Evaluation Activity at Marshall Space Flight Center. Robert R. Jayroe, Jr. Data Systems Laboratory.
N78-15728

Under the Office of Applications' Data Management Program, an algorithm evaluation activity was initiated to study the

problems associated with image processing by assessing the independent and interdependent effects of registration, compression, and classification techniques on Landsat data for several discipline applications. The objective of the activity was to make recommendations on selected applicable image processing algorithms in terms of accuracy, cost, and timeliness or to propose alternative ways of processing the data.

As a means of accomplishing this objective, an Image Coding Panel was established with members from several NASA Centers who represented different types of image processing interests. The Panel established the evaluation criteria, selected the data sets and algorithms, performed the analyses, and presented the results which were documented in the panel summaries. This report describes the conduct of the algorithm evaluation by Marshall Space Flight Center under approved RTOP 656-21-02-02 and in support of the Image Coding Panel.

TM-78149 December 1977
Vector Statistics of Landsat Imagery.
Robert R. Jayroe, Jr. and Debrah
Underwood. Data Systems Laboratory.
N78-15544

A digitized multispectral image, such as Landsat data, is composed of numerous four dimensional vectors, which quantitatively describe the ground scene from which the data are acquired. One of the purposes of this report is to investigate the statistics of unique vectors that occur in Landsat imagery and determine if that information can provide some guidance on reducing image processing costs. A second purpose of this report is to investigate how the vector statistics are changed by various types of image processing techniques and determine if that information can be useful in choosing one processing approach over another.

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TM-78150 January 1978
Effect of Shelf Aging on O-Ring
Materials. T. E. Wood and W. P. Stone.
Materials and Processes Laboratory.
N78-17156

Commercial O-rings made from 13 different rubber compounds were tested for physical properties when they were received from the manufacturer and after 7 and 12 years of shelf aging. No gross changes were observed in tensile strength, elongation, or compression deflection characteristics.

TM-78151 January 1978
Gravitation. A. J. Fennely. Space
Sciences Laboratory. N78-16522

This report discusses investigations of several problems of gravitation, including some aspects which are related to the Stanford University/Marshall Space Flight Center gyroscope experiment. In addition, the question of the existence of black holes is considered. While black holes like those in Einstein's theory may not exist in other gravity theories, trapped surfaces implying such black holes certainly do. The theories include those of Brans-Dicke, Lightman-Lee, Rosen, and Yang. A similar two-tensor theory of Yilmaz is investigated and found inconsistent and nonviable. The Newman-Penrose formalism for Riemannian geometries is adapted to general gravity theories and used to implement a search for twisting solutions of the gravity theories for empty and nonempty spaces. The method can be used to find the gravitational fields for all viable gravity theories. The rotating solutions are of particular importance for strong field interpretation of the Stanford/Marshall gyroscope experiment. Inhomogeneous cosmologies are examined in Einstein's theory as generalizations of homogeneous ones by raising the dimension of the invariance groups by one more parameter. The nine Bianchi classifications are extended to Rosen's theory of gravity for homogeneous cosmological models.

TM-78152 January 1978
The Solar Heating and Cooling
Commercial Demonstration Program -
Some Early Problems and Results.
Robert L. Middleton. Solar Heating and
Cooling Project Office. N78-16433

The origination of the Solar Heating and Cooling Commercial Demonstration Program by the Energy Research and Development Administration and the subsequent activities of the Marshall Space Flight Center of the National Aeronautics and Space Administration in the technical evaluation of proposals, contracts definitions, and program management details are defined and discussed.

During the period from initial site selection to present, a significant amount of experience has been gained which should be published to assist others in avoiding these problems. The significant problems are summarized in both technical and management aspects of the program.

It is concluded that the program has significantly stimulated additional solar effort by the program participants. It is also concluded that the use of conventional construction industry organizations with design/competitive bid procedures and standards has maintained a cost effective program.

TM-78153** January 1978
Test and Analysis of a Northrop
Collector Controller. D. R. Scott, R. R.
Kissel, and H. Reid. Electronics and
Control Laboratory. N78-16432

The collector controller is examined as a functioning control system that drives the Northrop collector from east to west to follow the Sun then back to the east at sundown in readiness for the next sunrise. The major components are examined separately with particular emphasis placed on an analysis of the electronic drive circuit.

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Results are presented from hardware testing and analysis with recommended changes to improve the system.

TM-78154 January 1978
Effect of Hydraulic Fluid (MIL-H-83282) on Selected Commercial O-Ring Compounds. T. E. Wood and W. P. Stone. Materials and Processes Laboratory. N78-18213

This report presents elastomeric materials compatibility data in MIL-H-83282 synthetic hydraulic fluid. Acrylonitrile and fluorocarbon compounds were evaluated at various temperatures and time intervals in samples of the fluid obtained from three qualified suppliers.

It was concluded that both polymers can function in the MIL-H-83282 hydraulic fluids within the conditions defined by this study. Hydraulic fluid from each manufacturer was similar in its effect upon each given O-ring material, with one exception. Similarly, there were no striking differences in the resistance of O-rings of the same generic rubber type when provided by the different manufacturers.

TM-78155 January 1978
Satellite Power System Work Breakdown Structure Dictionary. William S. Rutledge, David T. Taylor, and Joseph Hamaker. Program Planning Office.

A multiple dimension work breakdown structure (WBS) tailored to the unusual requirement of the Satellite Power System (SPS) project is displayed, and each of the WBS terms is defined. The system logic is discussed, and the interrelationship of the various elements of the WBS is described. The resulting WBS, while primarily structured to the unique cost, economic and programmatic requirements, is recommended for general use

by all parties involved in the definition and analyses of the SPS project.

TM-78156 January 10, 1978
Equal Period Orbit Determination for the Solar System Planets. Wilbur H. Funston. Data Systems Laboratory. N78-18092

Rendezvous and docking maneuvers by spacecraft often make use of equi-period orbits. For example, a spacecraft in circular orbit about the Earth's Moon may put an observation module into an elliptical orbit which lowers the perigee for a closer observation of the lunar surface. Use of equi-period orbits will bring the observation module back to rendezvous with the other module which has remained in circular orbit. There will be one rendezvous opportunity each revolution.

This report presents the determination of a set of equations for equi-period orbits work and a set of figures for quick reference.

TM-78157 February 1978
Vibration Effects on the Space Shuttle Main Engine High Pressure Oxidizer Turbopump Bellows. James A. Harp. Materials and Processes Laboratory. N78-19190

A welded metal bellows was subjected to a series of vibration tests in a 400 psi oxygen environment to evaluate the effects of the bellows convolutes rubbing on the damper ring in the High Pressure Oxidizer Turbopump of the Space Shuttle Main Engine.

The bellows was subjected to approximately 2 million cycles at 0.007 in. double amplitude displacement during this series of tests, at a frequency of 400 Hz.

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Instrumentation of the test specimen revealed no significant heat buildup caused by the rubbing of the bellows convolutes on the damper ring.

A final destruct test was made to determine if a fire would result if the bellows ruptured in the 400 psi oxygen environment, thus exposing a fresh metal surface. The vibration input was changed to 0.8 in. double amplitude displacement of 20 Hz to intentionally rupture the bellows. Failure occurred after 2.5 sec (50 cycles); no fire or heat buildup was encountered.

TM-78158 February 1978
High-Resolution, Continuous-Flow
Electrophoresis in Microgravity. Percy H.
Rhodes. Space Sciences Laboratory.
N78-19234

Although the possibility of using the reduced gravity of space as a means to enhance the performance of certain electrophoresis devices has been considered for several years, there has been no serious attempt to quantitatively compare electrophoresis performance on the ground with that anticipated in space. The computer mathematical models of various proposed electrophoresis systems that have been devised do not lend themselves to parameter optimization as do analytical expressions. Moreover, there has been no attempt to quantitatively determine the limits imposed on ground-based operation by thermal convection. This report derives approximate expressions which will allow estimation of performance enhancement in reduced gravity and also will direct optimization of the various design parameters for a continuous flow electrophoresis system.

TM-78159 February 1978
1977 Progress Report on Manufacturing
Techniques for Gravity Probe B Gyroscopes. John R. Rasquin. Materials and
Processes Laboratory. N78-19468

The purpose of this report is to present additional and improved techniques for the manufacture of Gravity Probe B gyroscopes. Improvements discussed include the redesign of the housings, new techniques for indentation of the electrode surfaces, and a new rotor ball lapping machine. These three items represent a significant improvement in operation of the gyroscope and also make possible the fabrication of a gyroscope which will meet flight requirements.

TM-78160 March 1978
Ground Winds and Winds Aloft for
Edwards, AFB, California (1978
Revision). D. L. Johnson and S. C.
Brown. Space Sciences Laboratory.
N78-19730

This report presents ground-level runway wind statistics for the Edwards AFB, California area. Crosswind, headwind, tailwind, and headwind reversal percentage frequencies are given with respect to month and hour for the two major Edwards AFB runways. Also presented are Edwards AFB bivariate normal wind statistics for a 90 degree flight azimuth for altitudes 0 through 27 km. Wind probability distributions and statistics for any rotation of axes can be computed from the five given parameters: \bar{u} , \bar{v} , $S(u)$, $S(v)$, and $R(uv)$. This document supersedes NASA TM-78136 and should be used in place of it.

TM-78161 March 1978
Thick Section Aluminum Weldments for
SRB Structures. E. Bayless and J.
Sexton. Materials and Processes Laboratory.
N78-19537

The Space Shuttle Solid Rocket Booster (SRB) forward and aft skirts were designed with fracture control considerations used in the design data. Fracture control is based on reliance upon nondestructive evaluation (NDE) techniques to detect potentially critical flaws.

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In the aerospace industry, welds on aluminum in the thicknesses (0.500 to 1.375 in.) such as those encountered on the SRB skirts are normally welded from both sides to minimize distortion. This presents a problem with the potential presence of undefined areas of incomplete fusion and the inability to detect these potential flaws by NDE techniques. To eliminate the possibility of an undetectable defect, weld joint design was revised to eliminate blind root penetrations. Weld parameters and mechanical property data were developed to verify the adequacy of the new joint design.

TM-78162

March 1978

An Evaluation of Grease Type Ball Bearing Lubricants Operating in Various Environments (Status Report No. 3).
E. L. McMurtrey. Materials and Processes Laboratory.
N78-20335

Because many future spacecraft or space stations will require mechanisms to operate for long periods of time in environments which are adverse to most bearing lubricants, a series of tests is continuing to evaluate 29 grease type lubricants in R-4 size bearings in five different environments for a 1 year period. Four repetitions of each test are made to provide statistical samples. These tests have also been used to select four lubricants for 5 year tests in selected environments with five repetitions of each test for statistical samples. At the present time, 65 test sets have been completed and 23 test sets are underway. Two (5 year) tests have already been started in (1) continuous operation and (2) start-stop operation, with both in vacuum at ambient temperatures. To date, in the 1 year tests, the best results in all environments have been obtained with a high viscosity index perfluoroalkylpolyether grease.

TM-78163**

March 1978

Owens-Illinois Liquid Solar Collector Materials Assessment. R. L. Nichols.
Materials and Processes Laboratory.

N78-21597

The Marshall Space Flight Center (MSFC) was requested by the Energy Research and Development Agency (ERDA) to assess the general suitability of the design and materials and to investigate certain failure modes of the Owens-Illinois (O-I) Sunpak solar energy collector system. The primary problem was the violent fracture of collector tubes, with attendant scattering of glass fragments, under boilout conditions.

This report presents the data and information generated during the materials analysis segment of this effort. These data were obtained during pressure testing of the individual tubes, performance testing of a complete array of tubes on the MSFC solar simulator apparatus, and in other investigations as noted. The information herein represents only the data directly associated with materials analysis and is not a comprehensive presentation of all the data compiled during the MSFC test program.

TM-78164

February 1978

Simplified Model of Statistically Stationary Spacecraft Rotation and Associated Induced Gravity Environments. George H. Fichtl and Robert L. Holland. Space Sciences Laboratory.

N78-21198

A simplified stochastic model of spacecraft motion is developed. The model is based on the assumption that the net torque vector due to crew activity and rocket thruster firings is a statistically stationary Gaussian vector process. The process has zero ensemble mean value, and the components of the torque vector are mutually stochastically independent. Each component of the torque

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vector is characterized by a constant, nonzero, spectral density function in the frequency interval $\omega_1 < |\omega| \leq \omega_0$ with zero spectral density for all other values of ω . The linearized rigid-body equations of motion are used to derive the autospectral density functions of the components of the spacecraft rotation vector which are shown to be proportional to ω^{-2} over the interval $\omega_1 < |\omega| \leq \omega_0$ and zero for all other values of ω . The cross-spectral density functions of the components of the rotation vector vanish for all frequencies so that the components of rotation are mutually stochastically independent. The autospectral and cross-spectral density functions of the induced gravity environment imparted to scientific apparatus rigidly attached to the spacecraft are calculated from the rotation rate spectral density functions via linearized inertial frame to body-fixed principal axis frame transformation formulae. The autospectral and cross-spectral densities of the induced gravity vector components are equal to nonzero constants over the frequency interval $\omega_1 < |\omega| \leq \omega_0$; however, the cross-spectral density functions are less than zero, thus indicating negative correlation between any two unlike induced gravity components in the principal axis frame of the vehicle. The induced gravity process is a Gaussian one with zero mean value. Transformation formulae are used to rotate the principal axis body-fixed frame to which the rotation rate and induced gravity vectors are referred to a body-fixed frame in which the components of the induced gravity vector are stochastically independent.

Rice's theory of exceedances is used to calculate expected exceedance rates of the components of the rotation and induced gravity vector processes. Application of the assumption that the number of exceedances of rotation rate and induced gravity over a given duration time T are Poisson distributed permits calculation of the risks associated with the components of the rotation rate and

induced gravity vectors exceeding specified critical values at least once as a function of experiment duration time.

TM-78165** April 1978
Use of the Marshall Space Flight Center Solar Simulator in Collector Performance Evaluation. William R. Humphries. Structures and Propulsion Laboratory. N78-21605

Details of the Marshall Space Flight Center (MSFC) solar simulator construction and operating characteristics are presented. Actual measured values from simulator checkout tests are detailed. Problems encountered during initial startup are discussed and solutions described. Techniques utilized to evaluate collector performance from simulator test data are given. Performance data generated in the simulator are compared to equivalent data generated during natural outdoor testing. Finally, a summary of collector performance parameters generated to date as a result of simulator testing are given.

TM-78166 April 1978
Solar Activity During Skylab - Its Distribution and Relation to Coronal Holes. David M. Speich, Jesse B. Smith, Jr., Robert M. Wilson, and Patrick S. McIntosh. Space Sciences Laboratory. N78-22994

Solar active regions observed during the period of Skylab observations (May 1973-February 1974) have been examined for properties that varied systematically with location on the Sun, particularly with respect to the location of coronal holes. Approximately 90 percent of the optical and X-ray flare activity occurred in one solar hemisphere (136-315 heliographic degrees longitude). Active regions within 20 heliographic degrees of coronal holes were below average in lifetimes, flare production, and magnetic

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complexity. Histograms of solar flares as a function of solar longitude have been aligned with H α synoptic charts on which active region serial numbers and coronal hole boundaries have been added.

TM-78167 April 1978
Space Processing Applications Bibliography. N78-23115

This document is a bibliography of articles, papers, and reports which discuss various aspects of the use of the space environment for materials science research or for commercial enterprise. Since the use of the space environment for materials science is a relatively new undertaking, it is the intent of this document to provide a consolidated reference for those new to the field.

The references are arranged chronologically, and several cross references are provided, as well as instructions for procurement of references.

TM-78168 April 1978
Shear Strength of Fillet Welds in Aluminum Alloy 2219. Charles V. Lovoy. Materials and Processes Laboratory. N78-21495

Fillet welds in aluminum alloy 2219 (2319 filler) are used in the fabrication and assembly of components for the Solid Rocket Booster (SRB) forward and aft skirts, External Tank (ET), and other support equipment. The fillet weld size is normally specified on the engineering drawing and is a theoretical dimension. In this report fillet size is discussed in terms of theoretical or design dimensions versus as-welded dimensions, drawing attention to the inherent conservatism in the design load sustaining capabilities of fillet welds.

Problems associated with inspection of fillet welds are addressed and a comparison is

drawn between defect counts obtained by radiographic inspection and by visual examination of the fracture plane.

Fillet weld quality is related linearly to ultimate shear strength. Correlation coefficients are obtained by simple straight line regression analysis between the variables of ultimate shear strength and accumulative discontinuity summation. Shear strength allowables were found to be equivalent to 57 percent of butt weld "A" allowables (F_{tu}).

TM-78169** May 1978
Design and Operation of a Solar Heating and Cooling System for a Residential Size Building. N78-25546

The first year of operation of the Marshall Space Flight Center's Solar House is discussed. Selected design information, together with a brief system description, is included. The house is equipped with an integrated solar heating and cooling system which uses fully automated state-of-the-art equipment. Overall performance for the first year is summarized. In addition, information pertaining to modifications made to improve performance is provided, and problems encountered during operation are discussed.

Evaluation of data from the first year of operation indicates that the MSFC solar house heating and cooling system is capable of supplying nearly 100 percent of the thermal energy required for heating and approximately 50 percent of the thermal energy required to operate the absorption cycle air conditioner. The lower percentage of energy provided for the cooling mode as compared to the heating-mode is due to the significantly higher temperature needed to operate the air conditioner, requiring the solar collector to operate at low efficiencies due to the higher inlet temperatures. Operation of the facility in the cooling mode has shown the need for basic subsystem improvements such as

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decreasing the operating temperature of the air conditioner and/or improving collector performance.

TM-78170 March 1978

An Analysis of Maximum Horizontal Wind Speeds and Associated Parameters Recorded at NASA's 150-Meter Ground Winds Tower Facility at Kennedy Space Center, Florida. Margaret B. Alexander. Space Sciences Laboratory. N78-24743

This report presents statistical summaries of the daily maximum horizontal wind speed and associated parameters from data recorded at the National Aeronautics and Space Administration's 150-Meter Ground Winds Tower Facility on Merritt Island, Kennedy Space Center, Florida. One year of continuous horizontal wind speed measurements processed by the Automatic Data Acquisition System is classified as a function of tower level (10, 18, 60, and 150 meters) and period of reference [day, month, season: winter (October through March) and summer (April through September), and annual]. Tabulations were made of the daily maximum horizontal wind speed, time of occurrence, and five associated parameters: mean horizontal wind speed, maximum vertical gusts (i.e., updraft and downdraft), and mean and instantaneous directions. Analyses using these data included means, extremes, standard deviations, and frequency distributions. Comparisons of intensity of maximum horizontal wind speeds determined in this year of data are made with maximum values recorded at Kennedy Space Center during another non-hurricane-occurrence year (1967) and with values during 1966 through 1972 when six hurricanes affected the area after the Ground Winds Tower Facility became operational in December 1965. The intent of this report is to provide additional information for the general description of wind flow in the lowest 150 meters of the atmosphere for the identification of hazards involved in wind

shear encounter relative to ascent and descent of the Space Shuttle and conventional aircraft.

TM-78171

April 1978

Electrets Used to Measure Exhaust
Cloud Effluents from Solid Rocket
Motor (SRM) During Demonstration
Model (DM-2) Static Test Firing. Michael
Susko, Space Sciences Laboratory.

N78-24281

The purpose of this experimental research was to compare Marshall Space Flight Center's (MSFC) electrets with Thiokol's fixed flow samplers during the Demonstration Model (DM-2) static test firing at Thiokol's static test site, January 18, 1978, near Brigham City, Utah.

The measurement of the rocket exhaust effluents by Thiokol's samplers and MSFC's electrets indicated that the Solid Rocket Motor (SRM) had no significant effect on the air quality in the area sampled. Thiokol had only one significant measurement. At Plant 78 (Site 12), approximately 6.43 km at a 330 deg heading from the static test stand, the fixed flow air sampler obtained a trace of contamination of 0.0017 mg/m³ (background) and 0.094 mg/m³ (test). Of this total weight, 0.0017 mg/m³ was of chlorine. Converting this to parts/million (ppm) gives 0.0006 ppm. At this site, from X-ray spectroscopy, the electret had a background count of 1667 and a test count of 2409, resulting in an increase of 742 counts. One of the additional electrets, E13, was closer to the static test site, approximately 585 m at a heading of 325 deg. The chlorine count from the X-ray spectroscopy analysis on this electret was 3576, an increase of 1909 counts. Equating the counts of 742 to 0.0006 ppm, 1909 counts equals 0.0015 ppm. Again, there was no measurement of significant rocket exhaust at the test site.

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The results show that the electrets (a passive device which needs no power) can be used effectively alongside existing measuring devices (which need power).

By placing electrets in areas where no power is available, measurements may be obtained. Consequently, it is a valuable complementary instrument in measuring rocket exhaust effluents in areas where other measuring devices may not be able to assess the contaminants.

TM-78172** May 1978
Hardware Problems Encountered in
Solar Heating and Cooling Systems.
Mitchell Cash. Solar Heating and Cooling
Project Office. N78-25539

Marshall Space Flight Center personnel have worked for several years with the development and demonstration of solar heating and cooling systems in support of the Department of Energy. In this work, they have encountered numerous problems in the design, production, installation, and operation of the solar energy systems. Many of these problems have been seen in more than one system. This report describes the hardware problems, which range from simple to obscure and complex, and their resolution. It is intended to provide personnel in the solar energy field with information that will help prevent the installation of solar heating and cooling systems that will not operate satisfactorily or that will not last for the design lifetime.

TM-78173 May 1978
Spacelab Mission 1 Experiment Descriptions. Paul D. Craven, Editor. Space Sciences Laboratory.

This document presents brief descriptions of experiments and facilities planned for Spacelab 1. These experiments and facilities were selected from the responses to the Announcement of Opportunity for the first Spacelab mission.

TM-78174 April 1978
Solid Rocket Booster Thrust Vector
Control Subsystem Test Report (D-1).
Boris Pagan. Structures and Propulsion
Laboratory. N78-25128

This report presents the results of the sequence of tests performed on the Space Shuttle Solid Rocket Booster thrust vector control subsystem by the Marshall Space Flight Center, Huntsville, Alabama. The tests were performed between July and December 1976.

The operational characteristics of the thrust vector control subsystem components, as determined from the tests, are discussed. Special analyses of fuel consumption, basic steady-state characteristics, GN_2 spin, and actuator displacement are presented which will aid in understanding the performance of the auxiliary power unit. The possibility of components malfunction is also discussed.

TM-78175 May 1978
Descriptions of Experiments Selected for
the Space Transportation System (STS)
Materials Processing in Space Program.
Robert J. Naumann, Editor. Space
Sciences Laboratory. N78-25103

This report presents the experiment description summaries for the first group of materials processing experiments planned for a Shuttle mission. The summaries give the objectives, the approach, the rationale for the use of space, and the anticipated results for each experiment. These experiments form the nucleus of the Materials Processing in Space program in the Shuttle era and provide the science requirements for the definition of the space processing facilities being developed for the Spacelab Module and Pallet.

TM-78176 June 1978
Weld Peaking on Heavy Aluminum
Structures. E. Bayless, R. Poorman, and
J. Sexton. Materials and Processes
Laboratory. N78-25427

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Weld peaking is usually undesirable in any welded structure. In heavy structures, the forces involved in the welding process become very large and difficult to handle. With the Shuttle's Solid Rocket Booster, the weld peaking resulted in two major problems: (1) reduced mechanical properties across the weld joint and (2) fit-up difficulties in subsequent assembly operation. Peaking from the weld shrinkage forces can be fairly well predicted in simple structures; however, in welding complicated assemblies, the amount of peaking is unpredictable because of unknown stresses from machining and forming, stresses induced by the fixturing, and stresses from welds in other parts of the assembly.

When excessive peaking is encountered, it can be corrected using the shrinkage forces resulting from the welding process. Application of these forces is discussed in this report.

TM-78177 May 1978
An Analysis of Maximum Horizontal Wind Speeds Recorded Since 1961 at Kennedy Space Center, Florida. Margaret B. Alexander. Space Sciences Laboratory. N78-26702

This report presents tabulations of maximum horizontal wind speed values recorded at the Kennedy Space Center since the Space Sciences Laboratory's Atmospheric Sciences Division began monitoring the winds in the area at Launch Complex 34 in 1961. Monitoring programs and beginning dates also include Launch Complex 37 in 1963, NASA's 150-Meter Ground Winds Tower Facility in 1965, Launch Complex 39A in 1967, and Launch Complex 39B in 1968. As expected, maximum wind speeds were recorded during the eight hurricanes which have affected the area — Cleo in August 1964 through Agnes in June 1972. Detailed tabulations and frequency distributions of daily maximum horizontal wind speeds recorded at NASA's

150-Meter Ground Winds Tower Facility at nine levels from December 1965 through March 1970 are also included.

TM-78179** July 1978
Final Report on MSFC Assessment of Owens-Illinois SUNPAK™ Collector Problems. Bernhard L. Wiesenmaier. Associate Director for Engineering Office.

Responding to a request from Energy Research and Development Agency (ERDA), Marshall Space Flight Center (MSFC) conducted an in-depth assessment of problems encountered with the Owens-Illinois SUNPAK™ collector installed in several ERDA solar system demonstration sites. The assessment included analysis and independent tests of the collector in the MSFC Solar Simulator where the system failure conditions were duplicated. The assessment showed the basic design of the SUNPAK™ collector to be sound; however, material limitations dictate that near-term applications constraints be recognized by system designers. MSFC recommendations were presented to ERDA in March 1977. Subsequent retrofit activity by Owens-Illinois appears to have been effective in demonstrating the integrity of the SUNPAK™ collector.

TM-78180** August 1978
Corrosion Inhibitors for Solar Heating and Cooling Systems. T. S. Humphries. Materials and Processes Laboratory.

This is a continuation of the test program, that was previously reported (NASA TN D-8409, February 1977), to find suitable and effective inhibitors for solar heating and cooling systems. Inhibitors which appeared promising in the previous tests and additional inhibitors including several proprietary products were selected for evaluation. Evaluation of the inhibitors was based on corrosion protection afforded an

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aluminum-mild steel-copper-stainless steel assembly in a hot corrosive water. Two inhibitors were found to be effective and show promise for protecting multimetallic solar heating systems.

TM-78181 July 1978
Ground Winds for Kennedy Space Center, Florida (1978 Version). D. L. Johnson and S. C. Brown. Space Sciences Laboratory.

This report presents ground-level runway wind statistics for the Kennedy Space Center, Florida area. Crosswind, headwind, tailwind, and headwind reversal percentage frequencies are given with respect to month and hour for the Kennedy Space Center Space Shuttle runway. This document supersedes NASA CR-128995 and should be used in place of it.

TM-78182** July 1978
Development, Testing, and Certification
of Life Sciences Engineering Solar
Collector — Final Report. John M.
Caudle. Solar Heating and Cooling
Projects Office.

This document summarizes final results of Contract NAS8-32255 for the development of an air flat plate collector for use with solar heating, combined heating and cooling, and hot water systems. The contract was for final development, testing, and certification of the collector, and for delivery of a 320 ft² collector panel.

TM-78183 August 1978
Apollo Telescope Mount - A Partial
Listing of Scientific Publications and
Presentations, Supplement 2. Space
Sciences Laboratory.

This report supplements NASA TMX-73300 and NASA TM X-73393. These reports are compilations of bibliographies from the principal investigator groups of the

Apollo Telescope Mount (Skylab solar observatory facility) that gathered data from May 28, 1973, to February 8, 1974. The analysis of these data is presently under way and is expected to continue for several years.

The publications listed in this report are divided into the following categories: (1) Journal Publications, (2) Journal Publications Submitted, (3) Other Publications, (4) Presentations – National and International Meetings, and (5) Other Presentations. An author index is included together with errata for the first report.

TM-78184 August 1978
Some Observations About Landsat
Digital Analysis. Robert R. Jayroe, Jr.
Data Systems Laboratory.

The results reported in this study support several hypotheses concerning Landsat data that need to be verified further or disproved by examining additional data and by independent investigation performed by other Landsat data users. The hypotheses are as follows:

1) Landsat does not discriminate vegetation types, but mostly sees chlorophyll and canopy cover.

2) A majority of the features in the ground scene possess linearly proportional amounts of "color" from each spectral band.

3) The data are continuous and as a result there is no true separability of ground scene features in the data, but some features possess an excess of color in a particular band pair.

4) There are relatively few features present in the spectral data, and these do not correspond to the conventional definitions that are used.

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5) Aside from seasonal effects, in a distributional sense all Landsat data are essentially the same. The only difference is the way the data are spatially arranged in the image.

TM-78185 July 1978
Sizing Tube-Fin Space Radiators. Jerry
A. Peoples. Preliminary Design Office.

Temperature and size considerations of the tube-fin space radiator are characterized by charts and equations. An approach of accurately assessing rejection capability commensurate with a phase A/B level output is reviewed using the analytical techniques developed by Donald B. Mackey. A computer program, based on Mackey's equations, is also presented which sizes the rejection area for a given thermal load. The program also handles the flow and thermal considerations of the film coefficient.

TM-78187 August 1978
SRB Materials and Processes Assessment
from Laboratory and Ocean Environ-
mental Tests. Materials and Processes
Laboratory.

The Materials and Processes Laboratory at the Marshall Space Flight Center recognized early in the Shuttle program that material performance on a long-term basis would be critical to the success of the Shuttle and its goal of reusable components. The laboratory instituted, in-house, a comprehensive series of materials tests simulating exposure of the refurbishable components of the propulsion system to expected flight and marine environments. These tests were subsequently expanded to include ocean environment exposure of these laboratory type samples. An Integrated Test Bed of 3.048 m (10 ft) diameter by 2.438 m (8 ft) high was also fabricated in support of this program. The Integrated Test Bed allowed large scale evaluation of principal manufacturing, insulating, cleaning and refurbishment methods.

This report gives the results and an assessment of the series of ocean environment tests that were conducted at Panama City and Kennedy Space Center, Florida, during the Spring and Summers of 1976 and 1977.

TM-78188* September 1978
The MSFC Complementary Metal Oxide Semiconductor (Including Multilevel Interconnect Metallization) Process Handbook. David L. Boulding, Richard W. Eastes, William R. Feltner, Ben R. Hollis, and Donald E. Routh. Electronics and Control Laboratory.

The fabrication techniques and procedure details for creation of Complementary Metal Oxide Semiconductor integrated circuits at George C. Marshall Space Flight Center are described. A unique feature of the MSFC process has been included, i.e., the use of multilevel metal interconnect patterns. Examples of C-MOS integrated circuits fabricated at MSFC with functional descriptions of each are given. Typical electrical characteristics of both P-channel Metal Oxide Semiconductor and N-channel Metal Oxide Semiconductor discrete devices under given conditions are provided. A general description of MSFC design, mask making, packaging, and testing procedures is included.

The capabilities described in this report are being utilized in: (1) research and development of new technology, (2) education of individuals in the various disciplines and technologies in the field of microelectronics, and (3) fabrication of many types of specially designed integrated circuits, which are not commercially feasible in small quantities, for in-house research and development programs.

TM-78189 August 1978
Radiative and Gas Cooling of Falling
Molten Drops. Michael B. Robinson.
Space Sciences Laboratory.

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This report calculates the supercooling rate and solidification time for molten drops of niobium, copper, and lead. Calculations for both radiation and helium gas cooling are presented in order to estimate the influence that the presence of helium gas would have upon the cooling rate of falling drops in the Marshall Space Flight Center space processing drop tube.

TM-78190

August 1978

Instruments for Measuring the Amount of Moisture in the Air. Dale L. Johnson. Space Sciences Laboratory.

This report presents a summarization and discussion of the many systems available today for measuring moisture in the atmosphere. Conventional methods used in the field of meteorology and methods used in the laboratory are discussed. Performance, accuracies, and response of the instruments are presented as well as the advantages and disadvantages of each. Methods of measuring humidity aloft by instrumentation onboard aircraft and balloons are given, in addition to the methods used to measure moisture at the Earth's surface. Much of the information contained in this report has been summarized from books, papers, and documents available in the open literature which are included as references.

TM-78191

August 1978

Evaluation of AAFE Apparatus to Measure Residual and Transient Convection in Zero-Gravity. R. C. Ruff, B. R. Facemire, and W. K. Witherow. Space Sciences Laboratory.

This report presents the results of an evaluation of an apparatus built by the Jet Propulsion Laboratory under Advanced Applications Flight Experiment (AAFE) program funding. The results are expected to contribute to an improved design for a Fluid

Experiments System (FES) planned for Spacelab 3. The detailed results are presented in four categories: (1) human factors, (2) electrical and mechanical, (3) optical performance, and (4) thermal performance.

*Blue cover reports printed at Langley.

**DOE/NASA reports.

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TP-1071 November 1977
Development of a Procedure to Model High-Resolution Wind Profiles from Smoothed or Low-Frequency Data. Dennis W. Camp. Space Sciences Laboratory. N78-11642

The FPS-16 radar/Jimsphere system used to obtain wind profile data for the altitude layer between the surface and approximately 18 km provides the most accurate and detailed wind measurements currently available. Therefore, this type of data has proven to be of exceptional value for use in aerospace research and development programs. With the advent of the Space Shuttle program, the importance of this type of data was again noted. However, the quantity of data necessary to provide the reliable high-resolution wind profiles for one of the possible launch sites, Vandenberg Air Force Base, California, was not available. The fact that sufficient time to obtain the data did not exist posed the problem of how the high-resolution wind profiles needed for the Space Shuttle program were to be developed. The method used to resolve this problem is the subject of this report; that is, the derivation of simulated Jimsphere wind profiles from low-frequency rawinsonde data and a generated set of white noise data. A computer program is developed to model high-resolution wind profiles based on the statistical properties of data from the Kennedy Space Center, Florida. Comparison of the measured Jimsphere data, rawinsonde data, and the simulated profiles shows excellent agreement. These simulated Jimsphere wind profiles will be used in design verification studies of the Space Shuttle operation for Vandenberg Air Force Base, California.

TP-1073 November 1977
Research in the Use of Electrets in Measuring Effluents from Rocket

Exhaust of the Space Shuttle (6.4 Percent Scaled Model) and Viking I Launch. Michael Susko. Space Sciences Laboratory. N78-11517

The purpose of this experimental research was to investigate electrets, a new device used to detect the chemical composition of rocket exhaust effluents. In assessing the effectiveness of electrets, comparisons were made with hydrogen chloride measuring devices from chamber and field tests and computed results from the NASA/MSFC Multilayer Diffusion Model.

The experimental data used in this investigation were obtained from the 18 static test firings at Marshall Space Flight Center, Huntsville, Alabama, chamber tests at Arnold Engineering Development Center, Tullahoma, Tennessee, and the Viking I launch to Mars on August 20, 1975, from Kennedy Space Center, Florida.

The results show that electrets have multipollutant measuring capabilities, simplicity of deployment, and speed of assessment. The electrets compared favorably with other hydrogen chloride measuring devices. The summary of the measured data from the electrets and the hydrogen chloride detectors is within the upper and lower bounds of the computed hydrogen chloride concentrations from the NASA/MSFC Multilayer Diffusion Model.

TP-1074 November 1977
A Design Handbook for Phase Change Thermal Control and Energy Storage Devices. William R. Humphries and Edwin I. Griggs. Structures and Propulsion Laboratory. N78-15434

This document gives a comprehensive survey of the thermal aspects of phase change

material devices. Fundamental mechanisms of heat transfer within the phase change device are discussed. Performance in zero-g and one-g fields are examined as it relates to such a device. Computer models for phase change materials, with metal fillers, undergoing conductive and convective processes are detailed. Using these models, extensive parametric data are presented for a hypothetical configuration with a rectangular phase change housing, using straight fins as the filler, and paraffin as the phase change material. These data are generated over a range of realistic sizes, material properties, and thermal boundary conditions. A number of illustrative examples are given to demonstrate use of the parametric data. Also a complete listing of phase change material property data are reproduced herein as an aid to the reader.

TP-1088 November 1977
Performance Analysis of Grazing Incidence Imaging Systems. Carl E. Winkler and Dietrich Korsch. Space Sciences Laboratory. N78-11812

An exact expression relating the coordinates of a point on the incident ray, a point of reflection from an arbitrary surface, and a point on the reflected ray is first derived. The exact relation is then specialized for the case of grazing incidence, and first-order and third-order systematic analyses are carried out — first for a single reflective surface and then for a combination of two surfaces. The third-order treatment yields a complete set of primary aberrations for single-element and two-element systems. The importance of a judicious choice for a coordinate system in showing field curvature to clearly be the predominant aberration for a two-element system is discussed. The validity of the theory is verified through comparisons with the exact ray-trace results for the case of the telescope.

TP-1164 February 1978
Analysis of Data Systems Requirements for Global Crop Production Forecasting

in the 1985 Time Frame. Sanford W. Downs, Paul A. Larsen, and Dietwald A. Gerstner. Data Systems Laboratory.

N78-18497

Starting with the description for the Global Crop Production Forecasting objective as given in "Outlook for Space," Marshall Space Flight Center undertook the task to define the data systems concepts that would be needed to implement this objective in an orderly transition from experimental to operational status in the 1985 time frame. The objective was carefully examined with consideration of the data system implications. Cognizant personnel were interviewed; data processing facilities were surveyed; the impact of future technology development was assessed; pertinent documentation was studied; and previous and current activities in this objective area were evaluated. This investigation served as the foundation for quantifying the objective by obtaining from the most important users their projected information needs. These information needs were then converted into data system requirements, and the influence of these requirements on the formulation of a conceptual data system was analyzed. Any potential problem areas in meeting these data requirements were then identified in an iterative process whereby the scoped objective was further refined as the analysis continued and recommended solutions and alternatives were developed.

TP-1220 April 1978
Evaluation of Materials for High Performance Solar Arrays (Status Report No. 1). A. F. Whitaker, C. F. Smith, Jr., C. L. Peacock, Jr., and S. A. Little. Materials and Processes Laboratory. N78-22233

A program has been underway to evaluate materials for advanced solar arrays which are required to provide power to weight ratios up to 100 W/kg. Severe mission environments together with the lack of

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knowledge of space environmental materials degradation rates require the generation of irradiation and outgassing engineering data for use in the initial design phase of the flight solar arrays. Therefore, approximately 25 candidate array materials were subjected to selected mission environments of vacuum, UV, and particle irradiation, and their mechanical and/or optical properties were determined where appropriate.

TP-1225 May 1978
Nuclear Waste Disposal in Space. R. E. Burns, W. E. Causey, W. E. Galloway, and R. W. Nelson. Systems Analysis and Integration Laboratory. N78-23571

This report presents a summary of a work on nuclear waste disposal in space conducted by the George C. Marshall Space Flight Center, National Aeronautics and Space Administration, and the following contractors: Battelle, Inc.; Northrop Services, Inc.; and Science Applications, Inc. From the aggregate studies, it is concluded that space disposal of nuclear waste is technically feasible.

The preferred baseline is as follows:

Kind of waste considered — Domestic civilian.

Waste mix to be carried — All wastes excluding unburned uranium and reactor cladding hulls. Carrying plutonium is optional.

Waste form — Calcine or calcine in metal matrix.

Launch site — Kennedy Spaceflight Center or a remote complex.

Launch vehicle — Space Shuttle.

Upper stage — LOX/H₂ high performance OTV.

Space destination — Lunar crater or solar orbit.

Safety philosophy — Work around to all system failures.

It is assumed that this report will be used in conjunction with the contractor reports.

TP-1227 May 1978
A Numerical Solution of the Navier-Stokes Equations for Chemically Nonequilibrium, Merged Stagnation Shock Layers on Spheres and Two-Dimensional Cylinders in Air. Kenneth D. Johnston and William L. Hendricks. Systems Dynamics Laboratory. N78-23390

Results of solving the Navier-Stokes equations for chemically nonequilibrium, merged stagnation shock layers on spheres and two-dimensional cylinders are presented. The effects of wall catalysis and slip are also examined. The thin shock layer assumption is not made, and the thick viscous shock is allowed to develop within the computational domain. The results show good comparison with existing data. Due to the more pronounced merging of shock layer and boundary layer for the sphere, the heating rates for spheres become higher than those for cylinders as the altitude is increased.

TP-1279 July 1978
Low Toxic Corrosion Inhibitors for Aluminum in Fresh Water. T. S. Humphries. Materials and Processes Laboratory. N78-28226

Combinations of chemical compounds that reportedly reduce the corrosion of

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aluminum in fresh water were evaluated. These included combinations of borates, nitrates, nitrites, phosphates, silicates, and mercaptobenzothiazole. Eight of fifty inhibitor combinations evaluated gave excellent corrosion protection and compared favorably with sodium chromate, which has generally been considered standard for many years.

TP-1280 July 1978
Thermodynamic and Chemical Parameters of the Exhaust Effluents from the HARPOON Booster Motor. J. Briscoe Stephens and Arnold I. Goldford. Space Sciences Laboratory. N78-28682

The exhaust products from the HARPOON booster motors have been analyzed using both thermodynamic analysis and finite-rate chemistry. The resulting constituents are presented together with a discussion of the techniques employed.

TP-1313 August 1978
Disposal of Radioactive Iodine in Space. Rowland E. Burns and J. Gregory Defield. Systems Analysis and Integration Laboratory.

The possibility of space disposal of iodine waste from nuclear power reactors is investigated. The space transportation system utilized relies upon the Space Shuttle, a liquid hydrogen/liquid oxygen Orbit Transfer Vehi-

cle (OTV), and a solid propellant final stage. The iodine is assumed to be in the form of either an iodide or an iodate, and calculations assume that the final destination is either solar orbit or solar system escape.

It is concluded that space disposal of iodine is feasible.

TP-1328 September 1978
The Effects of Curvature and Viscosity on Baroclinic Instability — A Two-Layer Model. William W. Fowles and Salvador Arias. Space Sciences Laboratory.

A linear stability analysis of a baroclinic zonal current contained between two parallel rigid boundaries is presented. Curvature is included by performing the analysis on a β -plane and viscosity by allowing for the effects of Ekman layers on the rigid boundaries. A two-layer model is used. This calculation was carried out to assist in the design of a spherical model of the general circulation of the Earth's atmosphere for Spacelab. In the low-gravity environment on an orbiting vehicle, a dominant radial dielectric body force, analogous to planetary gravity, can be achieved over a volume of liquid held between two concentric spheres. The results show the Eady short wavelength cutoff, and long wavelength cutoffs due to Ekman damping and curvature.

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| ALEXANDER, MARGARET B. | ES82 | Science 55th Annual Meeting to be held at Troy State University, Montgomery, Alabama. |
| LOGAN, E. | Arizona State University | |
| CHANG, J. | Arizona State University | |
| Building Wakes in Disturbed Layers. November 13-17, 1978. Presentation at the Conference on Atmospheric Environment of Aerospace Systems and Applied Meteorology to be held at New York, New York. | | |
| ANG, CHOH-YI | ES74 | |
| LACY, LEWIS L. | ES74 | |
| Gravitational Influences on the Liquid-State Homogenization and Solidification of Aluminum Antimonide. Submitted to Metallurgical Transactions. | | |
| ARTHUR, CARLENE W. | ES53 | |
| (NAS ASSOCIATE) | | |
| Pc4 Magnetic Pulsations at Synchronous Orbit, ATS-6. December 4-8, 1978. Presentation at the AGU 1978 Fall Meeting to be held at San Francisco, California. Submitted to EOS Transactions, AGU. | | |
| ARTHUR, CARLENE W. | ES53 | |
| Statistical Studies of Pc3 and Pc4 Magnetic Pulsations at Synchronous Orbit. Published in EOS, Transactions of the American Geophysical Union. | | |
| ASKINS, BARBARA S. | ES52 | |
| Autoradiographic Enhancement of Mammograms: Investigations of a Possible Dose Reduction. Published in Radiology. | | |
| ASKINS, BARBARA S. | ES52 | |
| Beta Radiation Autoradiography as a Technique for Restoring Faded Photographic Images. April 6-8, 1978. Presentation at the Alabama Academy of | | |
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| ASKINS, BARBARA S. | ES52 | |
| A Nuclear Chemistry Technique for Restoring Faded Photographic Images. Published in American Archivist. | | |
| ASKINS, BARBARA, et al. | ES52 | |
| Reduction in Mammography -- Preliminary Studies Utilizing Computer Enhancement and Autoradiographic Image Intensification. Submitted to Radiology. | | |
| ASKINS, BARBARA S. | ES52 | |
| A Demonstration of the Effect of Reduced Scatter on Information Content and Patient Exposure. August 1-3, 1978. Presentation at the American Association of Physicists in Medicine, Annual Meeting to be held at San Francisco, California. | | |
| AUSTIN, ROBERT E. | PS04 | |
| WOLFE, MALCOLM G. | | |
| Aerospace Corporation | | |
| Orbit Transfer Vehicles: An Enabling Capability for Space Platforms. September 27-29, 1978. Presentation at the AIAA Conference on Space Platforms: Future Needs and Capabilities to be held at Los Angeles. | | |
| BACCHUS, D. L. | ED32 | |
| MOOG, R. D. | Martin Marietta Corp. | |
| UTREJA, LAJPAT R. | | |
| Northrop Services, Inc. | | |
| Performance Evaluation of Space Shuttle SRB Parachutes from Air Drop and Scaled Model Wind Tunnel Tests. March 5-7, 1979. Presentation at the AIAA 6th | | |

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Aerodynamic Decelerator and Balloon
Technology Conference to be held at
Houston, Texas.

BAUGHER, CHARLES R. ES53
Low Energy Plasma in the Mag-
netosphere from ISEE-A. April 17-21,
1978. Presentation at the AGU 1978
Spring Meeting to be held at Miami
Beach, Florida.

BAUGHER, C. R. ES53
SHELLEY, E. G. Lockheed
YOUNG, D. T. Univ. of Bern-Switzerland
Field Aligned Flows of Thermal Ions in
the Plasma Trough: ISEE-I Observations.
December 4-8, 1978. Presentation at the
1978 Fall Meeting of the American
Geophysical Union to be held at San
Francisco, California.

BILBRO, J. W. EC32
Remote Measurement of the Transverse
Wind Speed Using Laser Doppler Radar
Intensity Fluctuations. Submitted to
Applied Optics.

BILBRO, JAMES W. EC32
CALHOUN, MALCOLM D.
Mississippi State University
Alternative Signal Processing Techniques
for a Pulsed Laser Doppler Velocimeter
System. April 1-4, 1979. Presentation at
the Southeastcon 79(IEEE) to be held at
Roanoke, Virginia.

BILBRO, JAMES W. EC32
POLGE, R. J. UAH
FFT Algorithms for the Spectral Proces-
sing of Pulsed Doppler Lidar Returns.
April 10-12, 1978. Presentation at the
Southeastcon 1978 to be held at
Atlanta, Georgia.

BILBRO, JAMES W. EC32
VAUGHAN, WILLIAM W. ES81
Wind Field Measurement in the Non-
precipitous Regions Surrounding Severe
Storms by an Airborne Pulsed Doppler
Lidar System. Published in the Bulletin
of American Meteorological Society.

BILBRO, JAMES W. EC32
VAUGHAN, WILLIAM W. ES82
Doppler Lidar Atmospheric Wind Meas-
urements. November 13-17, 1978. Pre-
sentation at the Conference on
Atmospheric Environment of Aerospace
Systems and Applied Meteorology to be
held at New York, New York.

BLAIR, JAMES C. ED11
Control System Technology and Trade-
offs for Large Space Structures.
September 27-29, 1978. Presentation at
the AIAA Conference on Space Plat-
forms: Future Needs and Capabilities to
be held at Los Angeles, California.

BRANTLEY, LOTT W. PD14
Space-to-Space Power Transmission
MSFC Space Construction Base/Power
Module Studies. May 31, 1978. Presenta-
tion at the Technology Requirements for
Future Orbital Power Systems meeting
to be held at Cleveland, Ohio.

CAMP, DENNIS W. ES82
ALEXANDER, MARGARET B. ES82
Variation of Horizontal Winds with
Height (Surface to 150-Meters).
November 13-17, 1978. Presentation at
the Conference on Atmospheric Environ-
ment of Aerospace Systems and Applied
Meteorology to be held at New York,
New York.

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CAMP, DENNIS W. ES82
FROST, WALTER FWG Associates, Inc.
Flight Through Thunderstorm Outflows.
September 10-16, 1978. Presentation at
the 11th Congress of the International
Council of the Aeronautical Sciences to
be held at Lisbon, Portugal.

CAMP, DENNIS W. ES82
FROST, WALTER
Univ. of Tennessee Space Institute
REDDY, RAVI
Univ. of Tennessee Space Institute
V/STOL Flight in Wind Disturbed by the
Presence of Buildings. August 7-9, 1978.
Presentation at the AIAA Atmospheric
Flight Mechanics Conference to be held
at Palo Alto, California.

CAMP, DENNIS W. ES82
FROST, WALTER FWG Associates, Inc.
WANG, S. T.
University of Tennessee Space Institute
Stable Boundary Layer Wind Shear
Model for Aircraft Flight Hazard Defini-
tion. November 13-17, 1978. Presenta-
tion at the Conference on Atmospheric
Environment of Aerospace Systems and
Applied Meteorology to be held at New
York, New York.

CARUSO, SALVADORE V. EC42
Some Aspects of Contamination Detec-
tion, Analyses and Control in Micro-
circuits for the NASA Space Shuttle
Program. April 24-26, 1978. Presenta-
tion at the 1978 Electronic Components
Conference to be held at Anaheim,
California.

CASH, MITCHELL FA32
Draft of Lessons Learned in Solar
Heating and Cooling Systems. September

8-9, 1978. Presentation at the Solar
Energy Short Course for Alabama Home
Builders Association to be held at
Birmingham, Alabama.

CASH, MITCHELL FA32
Hardware Problems in Solar Heating and
Cooling Systems. November 28 -
December 1, 1978. Presentation at the
Solar Heating and Cooling Systems
Operational Results Conference to be
held at Colorado Springs, Colorado.

CASH, MITCHELL FA32
Hardware Problems Encountered in
Solar Heating and Cooling Projects.
August 28-31, 1978. Presentation at the
American Section, International Solar
Energy Society Meeting to be held at
Denver, Colorado.

CHAPPELL, C. R. ES53
The New World of Thermal Plasma
Research. December 4-8, 1978. Presenta-
tion at the American Geophysical Union
Fall Meeting to be held at San Francisco,
California.

CHAPPELL, CHARLES R. ES53
The Solar Terrestrial Observatory.
January 16-18, 1978. Presentation at the
16th Aerospace Sciences Meeting to be
held at Huntsville, Alabama.

CHAPPELL, CHARLES R. ES53
The Solar Terrestrial Observatory.
September 27-29, 1978. Presentation at
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and Capabilities Conference to be held at
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| CLIFTON, K. S. | ES64 | CRAFT, HARRY G., JR. | JA12 |
| MILLMAN, P. M. | | First Spacelab Mission — A Status Report of the Joint ESA/NASA Mission. October 1-8, 1978. Presentation at the 29th Congress of the International Astronautical Federation (IAF) to be held at Dubrovnik, Yugoslavia. | |
| Herzberg Institute of Astrophysics | | | |
| Video Analysis of Cometary Debris. | | | |
| Submitted to Sky and Telescope. | | | |
| CLIFTON, KENNETH STUART | ES64 | DAVIDSON, MIRT C. | ES72 |
| OWENS, JERRY KEITH | ES64 | Crystal Growth in Space. October 18-20, 1977. Presentation at the American Astronautical Society Conference to be held at San Francisco, California. | |
| Monitoring of Particulate Contamination and Background Brightness from IECM Based Instrumentation. October 16-18, 1978. Presentation at the 10th Space Simulation Conference to be held at Bethesda, Maryland. | | | |
| CLIFTON, K. S. | ES64 | DAVIDSON, MIRT C. | ES72 |
| REESE, R. W., Jr. | ES64 | HOLLAND, LAWRENCE R. | ES72 |
| DAVIS, C. W. | ES64 | Narrow Zone Heating by a New Radiation Focusing Technique: Toroidal Ellipsoid Furnace. Published in Review of Scientific Instruments. | |
| Video Detection and Analysis of Transient Astronomical Phenomena. Submitted to Optical Engineering. | | | |
| COFFEY, RUSSELL | EF13 | DEATON, A. W. | EL23 |
| High Rate Data Acquisition from Spacelab/Shuttle. December 4-6, 1978. Presentation at the National Telecommunications Conference to be held at Birmingham, Alabama. | | KHATIB, A. R. | JPL |
| | | Shuttle/IUS Trajectory Design for Planetary Missions. August 7-9, 1978. Presentation at the 1978 AIAA/AAS Astrodynamics Conference to be held at Palo Alto, California. | |
| COFIELD, KESTER L., JR. | NA51 | DOWNS, SANFORD W., JR. | EF02 |
| A Unique Opportunity for Black Participation in Space. August 2-5, 1978. Presentation at the National Technical Association Conference "Black Roots in Technology" to be held at New York, New York. | | BIESBROCK, JOSEPH A. | |
| | | North Georgia College | |
| CRABTREE, WILLIAM L. | EC12 | Application of Remote Sensing Techniques to Study Southern Pine Beetle Infestations in the Georgia Piedmont. March 27-29, 1978. Presentation at the Seventh Annual Remote Sensing of Earth Resources Conference to be held at University of Tennessee Space Institute, Tullahoma. | |
| Technology Needs for Earth Orbital Solar Arrays. May 31 - June 1, 1978. Presentation at the Technology Requirements for Future Orbital Power Systems Symposium to be held at Lewis Research Center, Cleveland, Ohio. | | DOWNS, SANFORD W., JR. | EF02 |
| | | FAUST, N. L. | Georgia Inst. of Technology |
| | | The Use of Landsat Data to Inventory Cotton and Soybean Acreage in North | |

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- Alabama. March 27-29, 1978. Presentation at the 7th Annual Remote Sensing of Earth Resources Conference to be held at the University of Tennessee Space Institute, Tullahoma, Tennessee.
- EDGE, TEDDY M. EC45
The Standard Transistor Array Radix (STAR). November 14-16, 1978. Presentation at the GOMAC (Government Microcircuit Applications Conference) to be held at Monterey, California.
- FACEMIRE, BARBARA ES73
BOURGEOIS, S. V.
Lockheed Missiles & Space Co.
Liquid Spreading: ASTP Science Demonstration. January 16-18, 1978. Presentation at the AIAA 16th Aerospace Sciences Meeting to be held at Huntsville, Alabama.
- FELIX, A. RICHARD ED35
Effect of Sound Suppression Screens on Transonic Mach Number Distribution in the MSFC 14-Inch Trisonic Wind Tunnel. April 17-18, 1978. Presentation at the 49th Meeting of the Supersonic Tunnel Association to be held at El Segundo, California.
- FISHMAN, GERALD J. ES62
HEAO-1 Observations. Published in IAU Circulars.
- FISHMAN, G. J. ES62
The Nuclear Radiation Monitor for the Spacelab/Shuttle. Published in the proceedings of the Symposium on Gamma-Ray Spectroscopy in Astrophysics which was held at NASA, Goddard Space Flight Center.
- FISHMAN, G. J. ES62
MEEGAN, C. A. ES62
WATTS, J. W. ES62
DERRICKSON, J. H. ES62
New Limits on Gamma-Ray Bursts. Published in Astrophysical Journal (Letters).
- FOUNTAIN, JAMES A. ES64
WEST, EDWARD A. ES62
Thermal Conductivity, Thermal Diffusivity, and Specific Heat of Lunar Sample 15031, 38. March 1978. Presentation at the Ninth Lunar Science Conference to be held at Houston, Texas.
- FOUNTAIN, J. A. ES64
WEST, E. A. ES64
HORAI, K. Columbia University
WINKLER, J. L. Lockheed Electronic Corp.
KEIHM, S. J. Columbia University
LANGSETH, M. G. Columbia University
Thermal Conduction in a Composite Circular Cylinder: A New Technique for Thermal Conductivity Measurements of Lunar Core Samples. Submitted to the Journal of Geophysical Research.
- FOWLIS, WILLIAM W. ES82
A Spherical General Circulation Model for Spacelab. October 23-26, 1978. Presentation at the Atmospheric and Oceanic Waves and Stability Conference of the American Meteorological Society to be held at Boston, Massachusetts.
- FROST, WALTER
University of Tennessee Space Institute
HUTTO, MARSHALL
University of Tennessee Space Institute
CAMP, DENNIS W. ES82
Atmospheric Turbulence Spectra Behind Large Aspect Ratio Rectangular Blocks.

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(Available only from authors. Dates are presentation dates.)

February 26 - March 1, 1978. Presentation at the Third U.S. National Conference on Wind Engineering Research to be held at Gainesville, Florida:

GOETZ, OTTO K. EP21
Liquid Hydrogen as a Fuel - Liquid Hydrogen as a Rocket Fuel. December 10-15, 1978. Presentation at the ASME Winter Annual Meeting to be held at San Francisco, California.

GOLDEN, HARVEY EF21
NEIERS, JAMES General Electric
"Global Crop Production Forecasting" a Simulation Analysis of the Data System Problems and Their Solution. December 4-6, 1978. Presentation at the 1978 Winter Simulation Conference to be held at Miami Beach, Florida.

GOLDEN, HARVEY EF21
NEIERS, JAMES W. General Electric
Sensor Needs for Agricultural Applications. November 14-16, 1978. Presentation at the AIAA/NASA Conference on Smart Sensors to be held at Langley Research Center, Hampton, Virginia.

GRAVES, JIM EC12
LANIER, J. ROY EC12
LENOX, HERB EC12
A Modular Load Center Converter Power Supply. June 13-15, 1978. Presentation at the Power Electronics Specialists Conference to be held at Syracuse, New York.

GRODZKA, P. G.
Lockheed Missiles & Space Co., Inc.
FACEMIRE, BARBARA ES73
Chemical Reactions in Low-G. January 18, 1978. Presentation at the AIAA 16th

Aerospace Sciences Meeting to be held at Huntsville, Alabama.

GUYNES, BARRY V. FA33
Control Problems Experienced with Installed Solar Systems. May 23-25, 1978. Presentation at the Solar Controls Workshop to be held at Hyannis, Massachusetts.

HAGYARD, M. J. ES52
REICHMANN, E. J. ES52
SMITH, J. B. NOAA-ES52
SPEICH, D. M. NOAA-ES52
Prelare Enhancements in Soft X-Rays. May 29 - June 10, 1978. Presentation at the 21st Plenary Meeting of COSPAR to be held at Innsbruck, Austria.

HAGYARD, M. J. ES52
TEUBER, D. ES51
Comparisons of Measured and Calculated Potential Magnetic Fields. Submitted to Solar Physics.

HAGYARD, M. J. ES52
WEST, E. A. ES52
A Technique for Improved Spatial Resolution Using the Marshall Space Flight Center Magnetograph. June 26-30, 1978. Presentation at the 152nd Meeting of the American Astronomical Society to be held at Madison, Wisconsin. Published in the Bulletin of the AAS.

HAGYARD, M. J. ES52
WEST, E. A. ES52
Analyses of the 10 and 12 February 1978 Solar Flares in Active Region 1001. June 28-29, 1978. Presentation at the 152nd Meeting of the American Astronomical Society to be held at Madison, Wisconsin.

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HALL, RAYMOND R.	JA41	
RIVES, JAMES M.	JA71	tation at the AIAA Conference on Space Platforms: Future Needs and Capabilities to be held at Los Angeles, California.
Payload Integration and Operations. January 16, 1978. Presentation at the AIAA 16th Aerospace Sciences Meeting to be held at Huntsville, Alabama.		
HALL, STEPHEN BOYD	PD24	
Large Space Structures Assembly Simulation. September 27-29, 1978. Presentation at the AIAA Conference on Space Platforms: Future Needs and Capabilities to be held at Los Angeles, California.		
HAMILTON, EDWARD C.	PD01	
CAREY, W. T.	PD01	
Geostationary Communication Platform Design and Construction. September 27-29, 1978. Presentation at the AIAA Conference on Space Platforms: Future Needs and Capabilities to be held at Los Angeles, California.		
HAMITER, LEON	EC43	
VILLELLA, FELMINIO	EC43	
JOHNSON, GORDON M.		
McDonnell Douglas Astronautics Co. Factors Influencing Microcircuit Package Reliability. April 18-20, 1978. Presentation at the 1978 IEEE International Reliability Physics Symposium to be held at San Diego, California.		
HANKINS, JAMES D.	FA33	
Government Role on Development of Microprocessor Controllers System for Solar Heating and Cooling. May 23-25, 1978. Presentation at the Solar Controls Workshop to be held at Hyannis, Massachusetts.		
HARRISON, JAMES K.	PS03	
Large Space Structures Activities at MSFC. September 27-29, 1978. Presentation at the AIAA Conference on Space Platforms: Future Needs and Capabilities to be held at Los Angeles, California.		
HASTINGS, L. J.	EP43	
ALLUMS, S. L.	EP43	
Performance Characteristics of a 1.8 by 3.7 Meter Fresnel Lens Solar Concentrator. April 17-19, 1978. Presentation at the Third Southeastern Conference on Application of Solar Energy to be held at Huntsville, Alabama.		
HEALEY, HENRY M.	EP45	
CLARK, DAVID C.	EP45	
Evaluation of Rankine Cycle Air Conditioning System Hardware by Computer Simulation. April 17-19, 1978. Presentation at the Southeastern Solar Energy Conference to be held at the University of Alabama in Huntsville.		
HOOPER, JAMES W.	EF24	
PINER, JOHN R.	EF24	
Data System Dynamic Simulation. October 18, 1977. Presentation at the MSFC/UAH Data Management Symposium to be held at MSFC.		
HORWITZ, J. L.	ES53	
Plasmaphere Dynamics in A (U,B) Coordinate Representation. Published in Planetary and Space Sciences (Oxford, England).		
HORWITZ, J. L.	ES53	
BAUGHER, C. R.	ES53	
SHELLEY, E. G.		
Lockheed Palo Alto Research Lab		
YOUNG, D. T.		
Physikalishes Institut, Univ. of Bern Conical Pitch Angle Distributions of Low-Energy Ion Fluxes: Evidence for Cyclotron Acceleration. December 4-8,		

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1978. Presentation at the AGU 1978 Fall Meeting to be held at San Francisco, California. Submitted to the EOS Transactions, AGU.
- HORWITZ, J. L. ES53
CHAPPELL, C. R. ES53
Equatorial Observations of Low-Energy Plasma in the Dayside Plasma Trough. April 17-21, 1978. Presentation at the AGU 1978 Spring Meeting to be held at Miami Beach, Florida.
- HSU, J. P. ES63
Renormalizable Quantum Gravity and Dual Character of Space-Time. Submitted to General Relativity and Gravitation.
- HSU, J. P. ES63
Gravity and Gravitational Force. Submitted to Physical Review Letters.
- HSU, J. P. ES61
Observable Phase Factors and Symmetry of Electric and Magnetic Charges. Published in Foundations of Physics.
- HSU, J. P. ES63
A Finite Diagram-Theory for Yang-Mills Fields: I. Unitary and Gauge Independence. Submitted to Physical Review D.
- HSU, J. P. ES63
A Finite Diagram-Theory for Yang-Mills Fields: II. High Energy Amplitudes in the Sixth Order. Submitted to Physical Review D.
- HSU, J. P. ES63
Gravity as Yang-Mills' Space-Time Gauge Fields. Published in Physical Review.
- HSU, J. P. ES63
Static Yang-Mills Field with a Finite Energy and Its Physical Implications. Submitted to Physical Review D.
- HSU, J. P. NRC-ES61
SHERRY, T. N. University of Texas at Austin
Critical Comments on "On the Constancy of the Speed of Light." Submitted to Foundations of Physics.
- HSU, J. P. ES61
Analysis of Weak Interactions and Eötvös Experiments. Published in Physical Review Letters.
- HSU, J. P. ES63
A Generalization of Minkowski's Idea of the Four-Dimensional Symmetry. Submitted to the International Journal of Theoretical Physics.
- HSU, J. P. ES63
SHERRY, T. N. University of Texas at Austin
Common Time in a Four-Dimensional Symmetry Framework. Submitted to Foundations of Physics.
- HSU, J. P. NRC-ES61
TERRY, T. N. University of Texas at Austin
CHIU, C. B. University of Texas at Austin
The Speed of Light as Measured by Two Terrestrial Stable Clocks. Submitted to Physical Review.
- HSU, J. P. ES63
UNDERWOOD, J. A.
University of Texas at Austin
General Flat Four-Dimensional World Pictures and Clock Systems. Submitted to Foundations of Physics.

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HUMPHRIES, WILLIAM R. EP45
Collector Testing in the MSFC Simulator. April 17-19, 1978. Presentation at the Southeastern Conference on Solar Energy to be held at Huntsville, Alabama.

JOHNSON, GORDON M. McDonnell Douglas Astronautics Co.
VILLELLA, FELMINIO EC43
Reliability Evaluation of Opto-Couplers and Led's. April 18-20, 1978. Presentation at the 1978 IEEE International Reliability Physics Symposium to be held at San Diego, California.

JOHNSTON, J. DWIGHT EE01
BRITTON, W. R. Martin Marietta Aerospace
Space Spider - A Concept for Fabrication of Large Space Structures and Future Needs and Capabilities. September 27-29, 1978. Presentation at the AIAA Conference on Space Platforms: Future Needs and Capabilities to be held at Los Angeles, California.

JOHNSON, WILLIAM G. ES01
PARNELL, THOMAS A. ES01
VAUGHAN, W. W. ES01
Solar Induced Variations of Environment Affecting Manned Space Flight and Satellite Operations. Submitted to the Solar Terrestrial Prediction Proceedings.

JOHNSTON, MARY HELEN EH22
Materials in Space. June 22, 1978. Presentation at the 1978 Society of Women Engineers Convention to be held at Atlanta, Georgia.

JOHNSTON, M. H. EH22
PARR, R. A. EH22
Directional Solidification of Aligned Monotectic & Hyper-Monotectic Mate-

rials. November 29 - December 1, 1978. Presentation at the Conference on In Situ Composite III to be held at Boston, Massachusetts.

JONES, CHARLES O. EC32
Space Telescope Optics. Submitted to the Journal of the Society of Photo-Optical Instrumentation Engineers.

KAUFMAN, JOHN W. ES82
Wind Wheel Electric Power Generator (WWEPG). November 28 - December 2, 1977. Presentation at the Short Course on Wind Machines at the University of Tennessee Space Institute, Tullahoma, Tennessee.

KIEFLING, LARRY A. ED23
Solution of Shuttle Dynamics Problem Using SPAR. April 4-6, 1979. Presentation at the 20th Structures, Structural Dynamics and Materials conference to be held at St. Louis, Missouri.

KING, H. MARSHALL EH34
LEGGETT, H. Hughes Aircraft Co.
Porcelain Enamel Passive Thermal Control Coatings. May 24-26, 1978. Presentation at the AIAA/ASME Second Thermophysics and Heat Transfer Conference to be held at Palo Alto, California.

KRALL, K. R. ES52
The Evolution of Soft X-Ray Emitting Flare Loops. Submitted to the Astrophysical Journal.

KROSS, D. A. ED22
Space Shuttle solid Rocket Booster Decelerator Subsystem Drop Test Results. March 5-7, 1979. Presentation at the AIAA 6th Aerodynamic Decelerator Conference to be held at Houston, Texas.

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Program. March 5-7, 1979. Presentation
at the AIAA 6th Aerodynamic Decelera-
tor Conference to be held at Houston,
Texas.</p> | <p>LANZEROTTI, L. NRC-ES53
WEBB, D. University of New York
ARTHUR, C. W. ES53
Geomagnetic Field Fluctuations at
Synchronous Orbit, 2. Particle Radial
Diffusion. Published in the Journal of
Geophysical Research.</p> |
| <p>KRUPNICK, ALBERT C. FA32
Materials Technology and Solar Energy.
November 5-9, 1978. Presentation at the
Materials Problems in Emerging Energy
Sources Conference to be held at
Houston, Texas.</p> | <p>LAUE, JAY H. PS01
Shuttle/Tethered Satellite System.
March 8-10, 1978. Presentation at the
1978 Goddard Memorial Symposium to
be held at Washington, D.C.</p> |
| <p>LACY, L. L. ES74
ROBINSON, M. B. ES74
RATHZ, T. J. ES74
Drop-Tube Experiments in Undercooled
Niobium and Niobium Alloy Droplets.
February 18-20, 1979. Presentation at
the Modification of Microstructures by
Undercooling, AIME Annual Meeting, to
be held at New Orleans, Louisiana.</p> | <p>LEVINSON, JOHN EL03
Improved Protective Equipment through
Space Age Technology. October 23-25,
1978. Presentation at the NFPCA
Annual Conference to be held at Seattle,
Washington.</p> |
| <p>LANGFORD, J. ES53
HORWITZ, J. L. ES53
Inferring Trapped Plasma Distributions
Along a Magnetic Field Line from
Equatorial Measurements. April 18-21,
1978. Presentation at the AGU 1978
Spring Meeting to be held at Miami
Beach, Florida.</p> | <p>LEVINSON, JOHN R. EL03
Project Fires — Improved Protective
Equipment through Space Age Tech-
nology. September 10-12, 1978. Presen-
tation at the IAFC Annual Conference
to be held at Cincinnati, Ohio.</p> |
| <p>LANIER, J. R., JR. EC12
KAPUSTKA, ROBERT E. EC12
PERRY, EUGENE EC12
An Electrical Power System for a 25/100
kW Power Module. June 13-15, 1978.
Presentation at the Power Electronics
Specialists Conference to be held at
Syracuse, New York.</p> | <p>LIFER, C. E. EP41
Aerospace Structures Highlights of 1978.
(One paragraph to be included in article
by the Structures Technical Committee
of the AIAA). Published in the Astro-
nautics and Aeronautics Magazine.</p> |
| | <p>LOMBARDO, J. A. EP21
BLOUNT, D. H. EP24
Continuous Mode Propulsion: An Extension
of Mixed Mode Optimization.
February 13-16, 1978. Presentation at
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| LUNDQUIST, C. A. | ES01 | McMILLAN, R. S. | ES62 |
| JOHNSON, W. G. | ES01 | TAPIA, S. | University of Arizona |
| SMITH, J. B. | NOAA | Discovery of Linearly Polarized Continuum Light Scattered by the Shell Around Alpha Orionis. Published in the Bulletin of the AAS, 152nd Meeting of the AAS. | |
| Modulation of Atmospheric Ionization Corresponding to ^{14}C Production Variations. May 29 - June 19, 1978. Presentation at the 21st COSPAR Meeting, International Symposium on Solar Terrestrial Physics to be held at Innsbruck, Austria. | | McMILLAN, ROBERT S. | ES62 |
| LUNDQUIST, CHARLES A. | ES01 | TAPIA, S. | University of Arizona |
| VAUGHAN, WILLIAM W. | ES81 | Discovery of Polarized Light Scattered by Dust Around Alpha Orionis. Published in Astrophysical Journals (Letters) Center for Astrophysics. | |
| Analysis of Regression Method for Solar Activity Forecasting. July 24-28, 1978. Presentation at the Symposium/Workshop on Solar Terrestrial Influences on Weather and Climate to be held at Columbus, Ohio. | | McMURTREY, E. L. | EH14 |
| McDONOUGH, G. F. | EF01 | An Evaluation of Grease Type Ball Bearing Lubricants Operating in Various Environments (Status Report No. 3). October 1978. Presentation at the ASLE Annual Conference to be held in Minneapolis, Minnesota. | |
| An Energy Conserving Architectural Concept for the Solar-Powered Dwelling. April 17-19, 1978. Presentation at the Third Southeastern Conference on Application of Solar Energy to be held at Huntsville, Alabama. | | MEEGAN, C. A. | ES62 (NAS/NRC) |
| McMILLAN, R. S. | ES62 | FISHMAN, G. J. | ES62 |
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| McMILLAN, R. S. | ES62 | Spectrum of Cygnus X-1 from ~ 50 keV to ~ 3 MeV. Published in the AAS Bulletin and Presentation at the AAS 151st Meeting. | |
| New Constraints on the Composition of Interstellar Grain Mantles. Published in the Bulletin of the American Astronomical Society. | | MIDDLETON, ROBERT L. | FA33 |
| McMILLAN, R. S. | ES62 | Solar Heating and Cooling Commercial Demonstration Program at MSFC - Some Problems and Conclusions. April 27, 1978. Presentation at the Fifteenth Space Congress to be held at Cape Canaveral, Florida. | |
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| McMILLAN, R. S. | ES62 | Shuttle Induced Environment Contamination Monitors. March 7-9, 1978. Presentation at the International Spacecraft Contamination Conference to be held at Colorado Springs, Colorado. | |

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(Available only from authors. Dates are presentation dates.)

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| <p>MILLER, TERESA Y. ES73
BOLTZ, ROBERT C.
Universities Space Research Association
TODD, PAUL Pennsylvania State University
KUKULINSKY, NANCE E.
Pennsylvania State University
A Citrate Buffer System for Isoelectric
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graph, Electrophoresis 1978.</p> <p>MITCHELL, ROYCE E. EE11
Recovery Subsystem: An Overview.
March 5-7, 1979. Presentation at the
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ference, AIAA, to be held at Houston,
Texas.</p> <p>MORDAN, G. W. PF10
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Beyond the Baseline STS. September
27-29, 1978. Presentation at the AIAA
Conference on Space Platforms: Future
Needs and Capabilities to be held at Los
Angeles, California.</p> <p>MOSES, JAMES L. EP45
FOGAL, GORDON I. General Electric
SCOLLON, THOMAS R. General Electric
Atmospheric Cloud Physics Laboratory
Thermal Control. July 10-13, 1978.
Presentation at the 8th Intersociety
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be held at San Diego, California.</p> <p>NAUMANN, ROBERT J. ES71
Materials Processing in Space: A Strategy
for Commercialization. October 18-20,
1977. Presentation at the American
Astronautical Society Conference to be
held at San Francisco, California.</p> | <p>NAUMANN, ROBERT J. ES71
U.S. National Report on Materials
Processing in Space. May 29 - June 19,
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Meeting, Working Group 8, Materials
Science in Space, to be held at
Innsbruck, Austria.</p> <p>NICOLAS, DAVID P. EC43
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Microscope in Microcircuit Failure Anal-
ysis. December 11-15, 1978. Presenta-
tion at the ASME winter Annual Meeting
to be held at San Francisco, California.</p> <p>O'DELL, C. R. DS30
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GARY, G. A. ES62
An Echelle Spectrograph Study of the
Rosette Nubula. June 24-28, 1978.
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held at Madison, Wisconsin. Published in
the Bulletin of the AAS.</p> <p>ODOM, JAMES B. SA31
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Technology Down to Earth. May 16,
1978. Presentation at CRYO 1978 to be
held at Oak Brook, Illinois.</p> <p>OONK, R. L. Solaron Corporation
SHAW, L. E. Solaron Corporation
CASH, MITCHELL FA32
HUGHES, P. J.
Solar Energy Laboratory, Univ. of Wisconsin
MITCHELL, J. W.
Solar Energy Laboratory, Univ. of Wisconsin
Performance of Solar-Desiccant Cooling
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CASH, M.	FA32	Potential Reduction of X-Ray Exposure through Autoradiographic Intensification of Underexposed Radiographs. Published in Medical Imaging.	
Simulation of Air Based Solar Desiccant Cooling System. February 14-16, 1978. Presentation at the Solar Cooling Workshop to be held at San Francisco, California.			
OWEN, ROBERT B.	ES83	REASONER, DAVID L.	ES53
LIU, HUA-KUANG		Substorm-Associated Worm Plasmas of Ionospheric Origin Observed at Synchronous Orbit. February 8-11, 1978. Presentation at the NASA/American Geophysical Union Solar-Terrestrial Coupling Conference to be held at Yosemite National Park, California.	
University of Alabama in Huntsville A Coherent Optical Correlation Study of Surface Displacement: Submitted to Applied Optics.			
PALUDAN, C. T. N.	EF02	REYNOLDS, J. M.	ES61
CSATI, E.	Budapest, Hungary	FIELDS, S. A.	ES61
Eulusmap, an International Land Resources Map Utilizing Satellite Data. October 1-8, 1978. Presentation at the XXIX Congress, International Astronautical Federation to be held at Dubrovnik, Yugoslavia.		HOLLAND, R. L.	ES61
		X-Ray Reflectometer for Optical Efficiency and Scatter Measurements. Published in The Review of Scientific Instruments.	
PETERS, P. N.	ES63	RICE, WILLIAM C.	SA41
HOLDEMAN, L. B.	NBS	Economics of the Solid Rocket Booster for Space Shuttle. October 1-8, 1978. Presentation at the XXIX IAF - Congress 1978 to be held at Dubrovnik, Yugoslavia.	
Superconducting Properties of Iridium Thin Films. August 23-29, 1978. Presentation at the 15th International Conference on Low Temperature Physics to be held at Grenoble, France.			
PRICE, JOHN M.	FA31	RUFF, R. C.	ES74
Rankine Cycle Machine for Solar Cooling. November 27-29, 1978. Presentation at the AIAA Conference on Solar Energy: Technology Status to be held at Phoenix, Arizona.		ORAN, W. A.	ES74
		RATHZ, T.	ES74
		Mass Spectrometer for IECM. March 7-9, 1978. Presentation at the International Spacecraft Contamination Conference to be held at Colorado Springs, Colorado.	
		RUNKLE, ROY E.	EP14
		Space Shuttle Solid Rocket Booster Decelerator Subsystems - Air Drop Test	

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- Vehicle/B-52 Design. March 5-7, 1979. Presentation at the AIAA 6th Aerodynamic Decelerator Conference to be held at Houston, Texas.
- RUNKLE, ROY E. EP14
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- RUTLAND, CARY H. PS04
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- SCHUTZENHOFER, L. A. ED23
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GUEST, S. H. ED23
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- SCOTT, FRANCES E. MSFC
ZACHARY, A. University of Maryland
TAYLOR, M. E. University of Maryland
COLWELL, R. R. University of Maryland
A Method for Rapid Evaluation of Materials for Susceptibility to Marine Biofouling. Submitted to the International Biodeterioration Bulletin (England).
- SELTZER, S. M. ED12
Brief Description of Instrument Pointing System Dynamics and Control. March 10-14, 1978. Presentation at the Rocky Mountain Guidance and Control Conference to be held at Keystone, Colorado.
- SELTZER, S. M. ED12
Panel Discussion: Dynamics and Control of Large Space Structures. March 10-14, 1978. Presentation at the Rocky Mountain Guidance and Control Conference to be held at Keystone, Colorado.
- SELTZER, S. M. ED12
LIKINS, PETER W. Columbia University
Satellite Instrument Flexibility Specification Using Parameter Plane Stability Analysis. June 1978. Presentation at the 8th U.S. National Congress of Applied Mechanics to be held at Los Angeles, California.
- SFORZINI, RICHARD H. Auburn University
FOSTER, W. A., JR. Auburn University
SHACKELFORD, BENJAMIN W., JR. EP25
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- SHELTON, BILLY W. PD24
Advanced Earth-to-Orbit Transportation System/Candidate Propulsion Systems. July 24-26, 1978. Presentation at the 16th AIAA/SAE Joint Propulsion Conference to be held at Las Vegas, Nevada.
- SHIPMAN, DAVID L. EL12
Payload Specialist Training Scheduler (Pacts). December 4-6, 1978. Presentation at the 1978 Winter Simulation Conference to be held at Miami Beach, Florida.

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SPEICH, D. M. ES52
WILSON, R. M. ES52
REICHMANN, E. J. ES52

Long Duration Soft X-Ray Transients:
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Study of Traveling Interplanetary Phenomena.

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HUNG, R. J. UAH

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Ionospheric Observations on Acoustic-
Gravity Waves Associated with Severe
Storms. January 7-8, 1978. Presentation
at "Effects of Ionosphere on Space and
Terrestrial Systems" to be held at
Arlington, Virginia.

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HUNG, R. J. UAH

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Ray Tracing of Medium Scale Traveling
Ionospheric Disturbances (Gravity
Waves) Associated with Both a Group of
Tornadoes and Isolated Tornadoes. July
31 - August 8, 1978. Presentation at the
XIXth General Assembly USRI to be
held at Helsinki and Espoo, Finland.

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HUNG, R. J. UAH
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Speculation of Gravity Waves from
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ference to be held at Miami, Florida.

SMITH, R. E. ES81
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PHAN, T. UAH

Correlation of Convective Overshooting
Turrets and Gravity Waves Associated
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Presentation at the AGU Fall Meeting
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California.

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Doppler Sounder as Remote Sensing for
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Huntsville, Alabama.

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tion and Prediction of Severe Storms.
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Transfer of Remote Sensing Technology
to New Orleans Planning Organizations.
April 11, 1978. Presentation at the
Association of American Geographers
Annual Meeting to be held at New
Orleans, Louisiana.

SNODDY, WILLIAM C. ES51
Scientific and Technical Application of a
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| <p>STEWART, RODNEY D. EL02
 The Uses of Manhour and Material-Based
 Industrial Engineering Type Independent
 Cost Estimates: Submitted to The
 Government Executive.</p> <p>SUSKO, MICHAEL ES84
 Electrets Used in Measuring Effluents
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 Launch. Submitted to the Journal of
 Geophysical Research.</p> <p>SUTHERLAND, P. G. ES62
 WEISSKOPF, M. C. ES62
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 Time Variability of Cygnus X-1 from
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 California.</p> <p>TANDBERG-HANSSSEN, E. ES51
 COMFORT, R. H. ES51
 WU, S. T.
 University of Alabama in Huntsville
 Non-Force-Free Solar Magnetic Fields in
 Magnetohydrostatic Equilibrium. Sub-
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 NAKAGAWA, Y. High Altitude Observatory
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 SHEELEY, N. R.
 U.S. Naval Research Laboratory</p> <p>SMITH, J. B., JR. NOAA
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 STEINOLFSON, R. S.
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 Dryer, M. NOAA/ERL
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 Field. Published in the Astrophysical
 Journal.</p> <p>TAYLOR, KENNETH R. PS06
 Requirements and Resources for Mate-
 rials Processing in Space. September
 27-29, 1978. Presentation at the AIAA
 Conference on Space Platforms to be
 held at Los Angeles, California.</p> <p>TEUBER, D. L. ES51
 BREWER, G. A. ES51
 HAGYARD, M. J. ES51
 REICHMANN, E. J. ES51
 Image Data Processing for Displaying
 Correlations Between Coronal Holes and
 Extrapolated Solar Magnetic Fields. May
 29 - June 3, 1978. Presentation at the
 International Symposium on Solar Ter-
 restrial Physics to be held at Innsbruck,
 Austria. Published in Solar Physics.</p> <p>TEUBER, D. ES51
 Principal Component Analysis of Solar
 Flares in the Soft X-Ray Flux. May 29 -
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(Available only from authors. Dates are presentation dates.)

TEUBER, D. L.	ES52	URBAN, EUGENE	ES63
REICHMANN, E. J.	ES52	KARR, G. R.	
WILSON, R. M.	ES52	University of Alabama in Huntsville	
Principal Component Analysis of Solar Flares in the Soft X-Ray Flux. Submitted to Astronomy and Astrophysics.		Super Fluid Plug as a Control Device for Helium Coolant. Published in the Proceedings of the 71st Annual Meeting: American Institute of Chemical Engineers.	
THOMAS, CHARLES N.	FA32	VAUGHAN, OTHA H., JR.	ES83
Domestic Hot Water System for the Southeast. April 17-19, 1978. Presentation at the Third Southeastern Conference on Application of Solar Energy, Short Course on Energy Conservation and Exhibitions to be held at Huntsville, Alabama.		Zero-G Aircraft Simulations for Atmospheric Cloud Physics Research. January 15-17, 1978. Presentation at the AIAA 17th Aerospace Sciences Meeting to be held at New Orleans, Louisiana.	
THOMAS, CHARLES N.	FA31	VAUGHAN, O. H.	ES83
Results of Operational Testing on Direct and Indirect Types of Solar Domestic Hot Water Systems. August 28-31, 1978. Presentation at the Annual Meeting of American Section of International Solar Energy Society to be held at Denver, Colorado.		HUNG, R. J.	
THOMAS, CHARLES N.	FA32	University of Alabama in Huntsville	
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TURNER, JAMES R.	PD21	VON TIESENHAUSEN, GEORG F.	PS01
DeROACHER, W. L.	PD21	Satellite Power Systems (SPS). March 10-11, 1978. Presentation at the National Conference on Solar Energy to be held at Washington, D.C.	
Orbital Servicing of Space Platforms. September 27-29, 1978. Presentation at the AIAA Conference on Space Platforms: Future Needs and Capabilities to be held at Los Angeles, California.		WAITES, HENRY B.	ED12
		Application of Model Reference Adaptive Control to Instrument Pointing Systems. January 14-17, 1979. Presentation at the AIAA 17th Aerospace Sciences Meeting to be held at New Orleans, Louisiana.	

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| WEATHERS, HOYT M. | FA33 | WILSON, R. M. | ES52 |
| Rankine Cycle Machine for Solar Cooling. July 10-15, 1978. Presentation at the First International Conference on Energy and Community Development to be held at Athens, Greece. | | SMITH, J. B., JR. | ES52 |
| | | SPEICH, D. M. | ES52 |
| | | Physical Parameter Determination of the 9 August 1973 Subflare. Published in the Astrophysical Journal (Letters). | |
| WEISSKOPF, M. C. | ES61 | WITHEROW, WILLIAM K. | ES74 |
| SUTHERLAND, P. G. | ES62 | A High Resolution Holographic Particle Sizing System. Submitted to Optical Engineering. | |
| The Short-Term Time Variability of Circinus X-1 — A Comparison with Cygnus X-1. September 12-14, 1978. Presentation at the 1978 Annual HEAD Meeting on X-Ray and Gamma-Ray Astronomy to be held at La Jolla, California. Published in the Bulletin of the American Astronomical Society. | | WOJTALIK, FRED S. | EE71 |
| | | High Energy Astronomy Observatory Program (HEAO). June 12-16, 1977. Presentation at the Seventh IFAC World Congress to be held at Helsinki, Finland. | |
| WEISSKOPF, M. C. | ES61 | WU, S. T. | ES52 |
| SUTHERLAND, P. G. | MIT | REICHMANN, E. J. | ES52 |
| CANIZARES, C. R. | MIT | SMITH, J. B. | ES52 |
| A Measurement of the Time Sense of the Shot Noise Pulses from Cygnus X-1. Published in the Bulletin of the American Astronomical Society. | | HAGYARD, M. J. | ES52 |
| | | Energy Budget, Morphology and Evolution of McMath 14953. May 31, 1978. Presentation at the UAG Report to be held at Boulder, Colorado. | |
| WEST, EDWARD A. | ES52 | WYMAN, CHARLES L. | EE01 |
| Extending the Field of View of KD*P Electro-Optic Modulators. Published in Applied Optics. | | An Ultraviolet Polarimeter for the Solar Maximum Mission. Submitted to Optical Engineering, Journal of SPIE. | |
| WILSON, R. M., et al. | ES52 | WYMAN, CHARLES L. | EE01 |
| Magnetohydrodynamic Models of Coronal Transients in the Meridional Plane II. Simulation of the Coronal Transient of 1973 August 21. Submitted to the Astrophysical Journal. | | A Measurement Program to Examine Scattering and Reflection Characteristics of X-Ray Optics. Submitted to Optical Engineering, Journal of SPIE. | |
| WILSON, R. M. | ES52 | YOUNG, LEIGHTON E. | EC12 |
| SMITH, J. B. | ES52 | Development and Test of Solar Cells for Solar Electric Propulsion. June 5-8, 1978. Presentation at the IEEE Photovoltaics Specialists Conference to be held at Washington, D.C. | |
| SPEICH, D. M. | ES52 | | |
| Physical Parameters Analysis of an Intense Compact Sub-Flare. Submitted to Astronomy and Astrophysics (Europe). | | | |

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YOUNG, Leighton E. EC12
BARAONA, COSMO R.

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Status of Wraparound Contact Solar
Cells and Arrays. August 20-25, 1978.
Presentation at the 13th Intersociety
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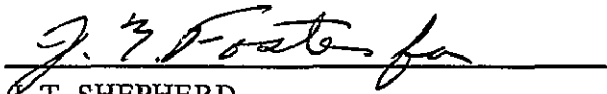
- CP-2019 May 11-12, 1977
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and Productivity Gains from Space
Technology. N77-30273
- CP-2024 February 14-16, 1977
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Conducted at the Utah State University,
Logan, Utah. Prepared by Space Sciences
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- CP-2026 May 26-27, 1976
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- CP-2027 September 20-21, 1977
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- CP-2028 March 1977
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ological and Environmental Inputs to
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Guntersville Workshop on Solar-
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Huntsville/NASA Workshop. Conducted
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national Spacecraft Contamination Con-
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The MSFC/UAH Data Management Sym-
posium. Albert Castelli, Editor.
- CP-2056 April 10-11, 1978
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William W. Vaughan, Editor.
- CP-2057 March 28-30, 1978
Proceedings: Second Annual Workshop
on Meteorological and Environmental
Inputs to Aviation Systems. Conducted
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- CP-2062 September 1978
Seventh NASTRAN User's Colloquium,
Papers to be presented at MSFC first
week in October 1978. Bob McComas.

APPROVAL

FY1978 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS

Compiled by O. L. White

The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or Atomic Energy Commission programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

A handwritten signature in cursive script, appearing to read "J. T. Shepherd", is written over a horizontal line.

J. T. SHEPHERD

Director, Administration and Program Support